Charles E. Kellogg

Edward F. Gruver Co.
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Washington, D. C.

C O N G O J O U R N A L

Charles E. Kellogg

1947

Schematic Route of Travels Overseas
1947
Described in
Mediterranean Journal——
and
Congo Journal – – – –

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CONGO JOURNAL /a

May, June, July

1947

Before leaving Washington for the Conference Internationale de Pedologie Mediterraneenne in southern France and Algeria, I had accepted an invitation of INÉAC (Institut Nationale pour l'Étude Agronomique du Congo Belge) to be their guest on a trip to the Belgian Congo in order to study the experimental work there and the soils and agriculture in the field.

May 27: Arrive in Brussels

After a meeting in Paris for discussion of a future International Congress of Soil Science/b, I leave by train for Brussels in the company of Dr. Pendleton who plans to remain only a few days. We are met at the station by M. Lebrun and M. Engelbeen of INÉAC who take Pendleton to his hotel and me to

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rooms at the Club de la Fondation Universitaire, 11 rue d'Egmont. First we call on Mr. Gospard, Agricultural Attaché at the American Embassy, and then change some American money into Belgian francs.

We take a little walk through the city and stop at a small restaurant for dinner. Brussels is in great contrast to Paris. Here there is abundant activity; everybody seems busy and the stores have everything to sell at high, but not unreasonable, prices. I doubt if there is anything one can get on Fifth Avenue in New York City that isn't for sale here, and without ration tickets.

Despite considerable damage from the war, Brussels is a beautiful city. After dinner I stop for awhile to admire the City Hall and rest in the twilight in a beautiful hillside garden a few blocks above it -- Mort des Artes.

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Up early to rearrange my baggage and leave as much as possible with Mr. Gospard at the Embassy. Then I go out and get my camera cases repaired and also a supply of soap, towels, tobacco, etc., as well as a tropical hat for use in the Congo. On the street one sees all sorts of food for sale, including large quantities of oranges from California. But apparently the Belgians like the Spanish oranges better since one may buy the Sunkist oranges for 6 francs per kilo while the Spanish Valencias sell for 8 francs.

A little before 9, I go out to the offices of INÉAC and meet the Director General in Brussels, M. Van Den Abeele, and others of the staff. At noon I am the guest at a most excellent luncheon with the Directing Board of INÉAC, including M. Van Straelen, et al.

Pendleton and I have a nice evening at supper with the Gospards where we meet Mr. Achilles (Charge de'Affaires) and others from the American Embassy.

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May 29: Brussels and Louvain

Although the Fondation Universitaire is an excellent club, smaller but nicer than our Cosmos Club, the late and early street cars are something to get used to. So I didn't sleep too well last night.

First in the morning I go for a short conference with M. Pierre Wigmy, Minister of Colonies, who has supervision over all of the activities in the Belgian Congo. I am well impressed with him. He has never been in the Colonies but intends to go soon. He has received training in economics and is a representative of the Catholic party in the present coalition government. Then I go to the office of Sobelair to check my tickets.

In the afternoon Engelbeen takes Dr. Pendleton and me out to Louvain University, east of Brussels, especially to see Professor Baeyens, who teaches soil science there and who wrote extensively on the Low Congo several years ago. Most of the soil between Brussels and Louvain is Gray-Brown Podzolic and appears to be developed from loess, or at least from some silty material like loess. Professor Baeyens is housed in a beautiful new agricultural building with completely up-to-date laboratories, museums, and the usual agricultural departments. After a rapid tour of the whole building we are taken to the Pedology Department.

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At the present time, Professor Baeyens is engaged in two main lines of work:

(1) Soil testing on thousands of samples from Belgian farms. He says he has around 150 to 200 per day to deal with. These are not collected by farmers themselves, but by over a thousand special collaborators who send in a rather complete form with the samples. (Copies attached) Technicians in the laboratory determine pH, total nitrogen, available phosphorus, exchangeable potassium, and organic carbon on each sample. Of course, this permits the calculation of the C/N ratio. On the basis of the records from a great many field experiments, the results of these tests are interpreted in terms of recommendations for the farmers.

Professor Baeyens says he has little use for American "quick test" kits. He thinks they are quite superficial. I feel that he likely is not informed of the more recent work in this field by Dr. Peech and others who do the work in the laboratory rather than in the field with the little kits. He uses the cobaltic nitrate test for potassium and insists, he says, on high accuracy within a narrow range of variation for Belgium.

(2) Fundamental pedology. Workers in this branch are giving a great deal of attention now to the problems involved in the reclamation of land flooded with sea water by the Germans. He says that 30,000 hectares were thus ruined, as in Holland. They

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STATION PÉDOLOGIQUE DE L'UNIVERSITÉ DE LOUVAIN
Téléphone : 916 Louvain
Parc d'Arenberg, Avenue Card. Mercier, HÉVERLÉ-LOUVAI

FORMULAIRE Ibis

BULLETIN DE RENSEIGNEMENTS
pour l'envoi d'échantillons de terre de vergers (1)

(Ne pas remplir cette case s. v. p.)

Date d'arrivée .....

Date envoi résult. ..... Numéro d'arrivée .....

Nom et adresse complète du fermier : .....

Nom et adresse du collaborateur local : .....

Dénomination de la parcelle : .....

Superficie de la parcelle : .....

Situation de la parcelle : .....

Numéros ou marques des échantillons de terre : .....

QUESTIONS	REPONSES
NOTE : L'expéditeur a tout intérêt à répondre d'une manière claire et complète aux questions posées.	
1. Quelle est **la nature du sol** de votre parcelle ? (Limon, sable, argile, bois défriché, polder, etc.)	.....
2. Quel est l'âge des arbres ?	.....
3. Le verger a-t-il été établi dans une prairie préexistante ? Dans l'affirmation, quel était l'âge de la prairie ?	.....
4. Quel **aménagement le sol avait-il subi lors de l'établissement de la plantation ?** Indiquez les **soins** donnés au sol (aménagement — fumure) lors de l'établissement du verger.	.....
5. **Quels espèces** et **quelles quantités d'engrais** ont été appliquées durant les **trois dernières années ?**	194 ..... / 194 ..... / 194 .....

(1) Remplir un formulaire pour chaque parcelle séparée. Le bulletin doit être envoyé à l'assistant en chef de la Station pédologique.

5. Quelles sont les **variétés** qui donnent le meilleur rendement ?

7. Quelles sont les variétés qui semblent **ne pas convenir ?**

a) aux bons endroits b) aux mauvais endroits

8. Quelle est d'après vous la **cause** des **mauvais** endroits ou des endroits **moins bons ?** Indiquer leur situation sur le croquis.

9. Cette parcelle a-t-elle déjà été **chaulée ?** Quand, et avec quelle espèce de chaux et quelle quantité ? Le chaulage a-t-il amélioré l'état de la végétation ?

10. Existent-ils des travaux de drainage ?

11. Avez-vous constaté des **maladies** ou des **dégats** — lesquels ?

Maladies ou dégâts	Variétés	Attaque forte	Attaque faible
a) sur les racines, branches et rameaux			
b) sur les feuilles			
c) sur les fruits			

12. **Constatations** spéciales faites **durant la croissance** des arbres tels que : arrêt dans la croissance après quelques années, chute des feuilles en été, chute précuaturée en automne, beaucoup de rejets, mort de certaines variétés, etc..

13. Quels **soins** a-t-on appliqué les dernières années : aspersion, bandages, élagage, etc. ? Ont-ils donné des résultats visibles ?

PROFIL 1

Marque du sachet	Profondeur de l'horizon	DESCRIPTION DES HORIZONS : Humus, couleur, compacité, racines, tâches de rouille, cailloux, structure, humidité, etc.

Appréciation générale du profil :

PROFIL 2

Marque du sachet	Profondeur de l'horizon	DESCRIPTION DES HORIZONS : Humus, couleur, compacité, racines, tâches de rouille, cailloux, structure, humidité, etc.

Appréciation générale du profil :

PROFIL 3

Marque du sachet	Profondeur de l'horizon	DESCRIPTION DES HORIZONS : Humus, couleur, compacité, racines, tâches de rouille, cailloux, structure, humidité, etc.

Appréciation générale du profil :

PROFIL 4

Marque du sachet	Profondeur de l'horizon	DESCRIPTIONS DES HORIZONS : Humus, couleur, compacité, racines, tâches de rouille; cailloux, structure, humidité, etc.

Appréciation générale du profil :

Appréciation générale de la parcelle basée sur la comparaison des divers profils entre eux et, si possible, des profils d'une parcelle voisine.

Croquis de la parcelle où les profils ont été examinés

INDICATIONS A DONNER :

a) **points cardinaux** : indiquer le Nord ——→ au moyen d'une flèche.
b) **pentes** : indiquer clairement les endoits où se trouve une élévation ou une dépression du terrain.
c) les **mauvais** ou **moins bons endroits** de la parcelle, productivité en dessous de la moyenne : trop sec en é
trop humide en hiver.
d) endroits où les arbres ont **une bonne croissance.**
e) endroits où les arbres **dépérissent** où **disparaissent**, où des **dégâts** et des **maladies** ont été constatés.
f) fossés, rivière, chemins, rues, chaussées, bois environnants, etc...
g) les **noms** et **l'emplacement** des **variétés.**

Il est à conseiller de faire le croquis à **une échelle suffisamment grande,** pour que toutes les indications puisse
y être notées d'une manière suffisamment claire.

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Appréciation générale du profil :

PROFIL 2

Marque du sachet	Profondeur de l'horizon	DESCRIPTION DES HORIZONS : Humus, couleur, compacité, racines, tâches de rouille, cailloux, structure, humidité, etc.

Appréciation générale du profil :

PROFIL 3

Marque du sachet	Profondeur de l'horizon	DESCRIPTION DES HORIZONS : Humus, couleur, compacité, racines, tâches de rouille, cailloux, structure, humidité, etc.

Appréciation générale du profil :

PROFIL 4

Marque du sachet	Profondeur de l'horizon	DESCRIPTIONS DES HORIZONS : Humus, couleur, compacité, racines, tâches de rouille, cailloux, structure, humidité, etc.

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Appréciation générale de la parcelle basée sur la comparaison des divers profils entre eux et, si possible, des profils d'une parcelle voisine.

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g) les **noms** et **l'emplacement** des **variétés**.

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SERVICE PÉDOLOGIQUE DE BELGIQUE
TéL. 916 Parc d'Arenberg, Avenue Card. Mercier, Héverlé-Louvain

BULLETIN D'ANALYSE DE TERRE

Nom et adresse du fermier :

Nom et adresse du collaborateur local :

RÉSULTATS D'ANALYSE

Dénomination de la parcelle :

N° Région agricole
N° Bulletin (1)

N° du laborat.	N° du sachet	PH.	Besoin en chaux (2)	Acide phosh. soluble	Potasse échang.	Teneur en carbone	Teneur en azote	Rapport C/N

INTERPRÉTATION DES RÉSULTATS (3) :

Louvain, le 19 *Le Directeur,*

En présence de ce bulletin, l'Agronome de l'Etat ou le conseiller d'horticulture de l'Etat de votre circonscription peut vous donner gratuitement des renseignements concernant la fumure rationnelle de vos terres. Il peut vous donner en même temps gratuitement tout autre renseignement concernant l'exploitation agricole en général.

1) Ce numéro doit être rappelé dans la correspondance éventuelle concernant le présent bulletin.
2) Le besoin en chaux est exprimé par Ha. et en chaux pure. La quantité de chaux à appliquer doit être augmentée d'après l'espèce de chaux employée.
3) Nous entendons par « dose » d'un élément nutritif le nombre d'unités de cet élément qu'il faut appliquer pour la culture suivante, exprimé par Ha. Si éventuellement une dose de fumier de ferme ou de purin sera appliquée, il faut en tenir compte.

La publication des résultats d'analyse reste la propriété de la Direction du Service Pédologique.

SERVICE PÉDOLOGIQUE DE BELGIQUE

Parc d'Arenberg, Avenue Ceres, Mercier, Heverlé-Louvain

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N° Bulletin

N° du labora.	N° du sachet	PH.	Besoin en chaux (2)	Acide phosph. soluble	Potasse échang.	Teneur en carbone	Teneur en azote	Rapport C/N

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En présence de ce bulletin, l'Agronome de l'Etat ou le conseiller d'horticulture de l'Etat de votre circonscription peut vous donner gratuitement des renseignements concernant la fumure rationnelle de vos terres. Il peut vous donner en même temps gratuitement toute autre renseignement concernant l'exploitation agricole en général.

Ce numéro doit être rappelé dans la correspondance éventuelle concernant le présent bulletin.

Le besoin en chaux est exprimé par Ha. et en chaux pure. La quantité de chaux à appliquer doit être augmentée d'après l'espèce de chaux employée.

Nous entendons par « dose » d'un élément nutritif le nombre d'unités de cet élément qu'il faut appliquer pour la culture suivante, exprimé par Ha. Si éventuellement une dose de fumier de ferme ou de purin sera appliquée, il faut en tenir compte.

La publication des résultats d'analyse reste la propriété de la Direction du Service Pédologique.

SERVICE PÉDOLOGIQUE DE BELGIQUE

Téléphone : 916 Louvain — Parc d'Arenberg, Avenue Card. Mercier 16, Héverlé-Louvain

CIRCULAIRE 1B

Bulletin collectif

BULLETIN DE RENSEIGNEMENTS POUR L'ENVOI D'ECHANTILLONS DE TERRE (1)

(Indications à remplir au laboratoire.)

Date d'arrivée .....

Date arrivée échant. : .....

Nom et adresse complète du fermier : (2)

.....

.....

.....

.....

Nom et adresse du collaborateur local :

.....

.....

.....

.....

Situation des parcelles :
(chemin-hameau .....

.....

.....

Numéros ou marques des échantillons de terre : .....

.....

REMARQUE IMPORTANTE. Le bulletin collectif ne peut être employé que si 2 ou plusieurs parcelles doivent être échantillonées chez un même fermier. Pour une seule parcelle employer le formulaire I.

Ce bulletin collectif a été spécialement conçu pour faciliter le travail de nos collaborateurs, mais sous aucun prétexte l'exactitude et la variété des renseignements ne peuvent en souffrir. Les renseignements ayant une importance spéciale pour une parcelle déterminée doivent être donnés d'une façon claire et précise.

(1) Pour la prise d'échantillons, consulter le formulaire N° 2. Les bulletins ainsi que toute la correspondance sont à adresser par courrier postal au Directeur du Service Pédologique.

(2) Lorsque les parcelles sont situées dans une autre commune que le domicile réel du fermier, renseigner la commune où sont situées les parcelles, en indiquant entre parenthèses l'adresse privée du fermier.

N° et Marques des échantill.	DÉNOMINATION DE LA PARCELLE	Espèce de sol — Sable - Limon etc.	Superf. Parc.	CULTURES PRÉCÉDENTES AVEC FUMURE ET RENDEMENT			Cult pr
				194	194	194	
				Cult. Fum. Rend.			
				Cult. Fum. Rend.			
				Cult. Fum. Rend.			
				Cult. Fum. Rend.			
				Cult. Fum. Rend.			
				Cult. Fum. Rend.			

e avec fumure le fermier	Estimat. rendement par année, avec causes problables d'échec	Chaulage - Année Quantités Sorte de chaux	Nappe phréatique (Sec - Humide - Drainage)	Maladies avec remarques	Mauvaises herbes	Remarques sous-sol.	Analyses précédentes avec no bulletin. Essais et autres remarques

Croquis collectif des parcelles où les échantillons de terre ont été prélevés

NOTE : Indiquez sur ce croquis d'une façon exacte et complète : l'orientation, les champs, les bois, les prairies, les chemins, les pentes, le
rivières ou fossés voisins, etc., et les endroits exacts où les échantillons ont été prélevés. (Centre de chaque échantillon moyen.)
Indiquez surtout l'endroit où le terrain est plus élevé ou plus bas, les pentes, collines, dépressions, etc.
Le croquis doit être dressé de telle façon que les parcelles puissent être retrouvées par une tierce personne (indiquer fermes, routes voisines, etc.

At Louvain University. Baeyens, Kellogg, and Pendleton.

P-0 A

Pamphlets 1565

At Louvain University. Baeyens, Kellogg, and Pendleton.

have found that the condition of the soil colloids, including effects of the exchangeable bases, is very important, above all on influencing soil structure. He insists that he has a very accurate "single value" for structure. It is the percolation rate of water through soil in the bottom of small glass cylinders about 1½" x 12" under a continuous head of tap water. Cloth is placed above the stopcock at the bottom. The top of the glass cylinder is fitted with a stopper, including a glass intake tube. Certainly this measures something besides structure. These cylinders are set up in large batteries in such a way that the soil may be admitted from the top into the water and to many tubes at once. The soil settles by itself immediately. Professor Baeyens points out that the apparatus does not work with highly organic soils. He uses this test to advise farmers regarding the amount of calcium sulphate to use in the reclamation of soils flooded with salt water. The amount varies greatly from field to field. He emphasizes that the gypsum must be used before tillage. He not only recommends the amounts to use but also the timing of the application and the kind and timing of tillage.

In this laboratory an attempt is being made to devise a test of catephoresis of soil colloids in suspension after treatment with various concentrations of different salts, which presumably duplicate the conditions of inundation. With the microscope, they measure the colloid movement along a scale, under

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In this laboratory they also measure the "total biological activity" of soils by measuring CO_2 absorption.

They use the Mitscherlich pot tests and have designed the apparatus to keep a constant head of water in the lower pots so that each plant "has optimum moisture".

Professor Baeyens explains that he has another volume on the soils of Central Africa ready for the press. He has a large collection of soil samples from the Belgian Congo, including some unsatisfactory monoliths.

Before leaving Louvain we visit the famous library destroyed by the Germans in the First World War and rebuilt through American aid. When the Germans entered Louvain in the Second World War the library was immediately destroyed under the direct orders of Hitler in revenge for its mention in the Versailles Treaty. Reconstruction work is again in progress. The outside of the building is mostly in good shape; the inside was completely destroyed by burning gasoline.

I return to Brussels and move to the Hotel Albert since my bus for the airport leaves from this hotel very early in the morning.

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May 30: Brussels to Tunis

I am up at 4:30 a.m. in order to be ready for an early trip to the airfield. I am out at the field at six o'clock, weigh in, check baggage, and then stand about for the usual delays. It is a bright sunny morning with not a cloud in the sky. The plane is a two-motored American P-47 made over from one used by American parachutists.

We take off at seven o'clock. From the air one sees a great deal more war damage than from a car on the ground. I realize now that most of the buildings between Brussels and Louvain have been rebuilt or repaired since the war. Repair work must have gone on very speedily although one still sees many huge shell holes. There are some scattered farms in southern Belgium and northern France, but less than I had formerly supposed. Most of the farmers live in villages.

We fly near Lyon, somewhat east of Avignon, and over the French Alps. These appear to be rugged and dry. There is fair forest on the northeast slopes; the south and southwest slopes are shrubby and used for grazing. There are only a few small scattered fields.

Here I ride for awhile in the co-pilot's seat. Then the pilot leaves and there is no one at all at the controls for awhile!

One sees a good deal of geological erosion and probably

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K-1343 May 30, 1947
Farm land pattern in northern France.

K-1343 May 30, 1917
Farm land pattern in northern France.

K-1344 May 30, 1947
France. View of west side of Rhone Valley north of Lyon.

K-1345 May 30, 1947
In French Alps, just north of Drôme River.

K-1344 May 30, 1917
France. View of west side of Rhone Valley north of Lyon.

K-1345 May 30, 1917
In French Alps, just north of Drôme River.

the area of arable land has been reduced by accelerated erosion. But there is no way to tell. I see a few cultivated trees but most of the crops are cereals, hay, and pasture. I see evidence of old terraces now abandoned and some terraces that are maintained. Only a few of the ridge tops are smooth enough for pasture or even forest; most are very narrow and rocky. The stream beds are gray and now have very little water in them. We pass on the east side of Mt. Ventoux (1912 meters). South of the mountains the lower slopes have some red soil, probably Terra Rossa. We pass the Durance River. Most of the soil is gray between the Alps to the north and the long slope to the river. This slope is largely cultivated. Beyond the river we fly over discontinuous fleecy clouds. The soil is largely grayish-brown for some distance with spots of brown and reddish-brown. Much of the land is now in fallow. This general type of landscape continues to the Mediterranean except for much hilly gray shrubby land in a rather wide coastal strip. We cross the seashore about midway between Marseille and Toulon. As we come over the sea it becomes chilly and I go back to my seat in the plane.

About 12:25 Tunisia comes into view. From the plane the land looks a pale brown and very dry. Most of it is rolling and appears to be cereal stubble and fallow.

We are down at the airport in Tunis at 12:55. Then we have the usual delays again. Some inexperienced travellers have

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not sorted their baggage and have several suitcases for one night; then we all must go through customs. Finally we get cleared and go into a bus provided by Sobelair.

As we drive into the edge of Tunis, we visit some ruins of old Carthage over which is now the modern Carthage. We stop for refreshments at a hotel overlooking the bay. There is not much evidence of destruction except for a partly sunken ship in the harbor. The view resembles the outskirts of Algiers in architecture but everything seems much drier. In the lower places the soil is obviously salty. I suspect that originally the soils were mainly Reddish-Brown and Rendzina. For me it is such a waste of time to sit here waiting for a drink that I don't want anyway, but there is no help for it. I walk out a little way to visit an old church -- nice but not very interesting. Then I wait a little while longer while the captain drinks.

Finally we go to our hotel for the night. The soil along the route is gray and grayish-brown with "croûte calcaire." I see some irrigated maize and vegetables, and some vines, but most of the cropland near the city is in cereals. One gets the impression of extreme drought and rather poor husbandry. I see a few small date gardens and fig gardens.

I have room 128 in the Majestic Hotel. There is time for a short nap and then at seven I go to the Tunisia Palace Hotel for dinner.

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K-1346 May 30, 1947
Tunis. View near site of old Carthage.

K-134b May 30, 1917
Tunis. View near site of old Carthage.

May 31: Tunis to Cairo

I am up at 4:45 a.m. and wait a little for the captain. We see a beautiful sunrise on the way to the airport. At 6:57 a.m. we are in the air for Cairo. We are immediately over discontinuous low clouds that hang over the seashore. On the peninsula near Tunis the soils are rolling and rather well dissected. They have cereals, fallow, and shrubby pasture. Beyond, the land is more level, probably Rendzina and Reddish-Brown. It is nearly all tilled. One sees both villages and scattered farms.

We leave the land and for a long time fly over the Mediterranean Sea. We come near the shore of Cirenaica at about Cirene. The land along the shore is strongly sloping, well dissected, and eroded. It has mostly a thin shrubby cover with only a few patches of cereals on selected gently sloping spots. Most of the soil is reddish, but there are spots of gray. (The stewardess passes port wine. Yesterday we had soup at about 10, port wine about 11, followed by lunch at 12, and whiskey or brandy at 2:40. But today she adds a bottle of wine at 11:15.)

Near Derna the land looks very dry with many black spongy rock outcrops. The hills and stream courses seem to be lined with whorls where erosion has very slowly cut the nearly level layers of brown rock. The tops of the hills may be cultivated as well as some of the broader areas in the valleys. In the

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K-1347 May 31, 1947
Cirenaica. West of Ain el Gazala.

K-1348 May 31, 1947
Cirenaica. View of Tobruch.

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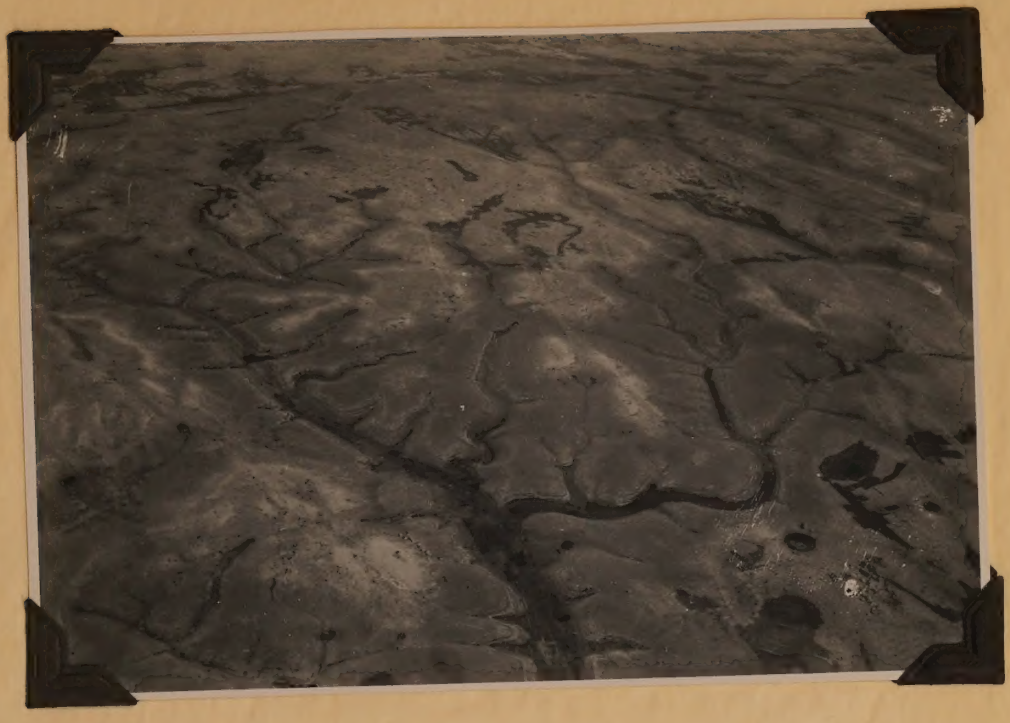

K-1349 May 31, 1947
Cirenaica. Tiny fields in valley within the desert west of Bardia.

K-1350 May 31, 1947
Egypt. Just east of Zawyet Shammas - view of field. Pattern on Sierozem soil.

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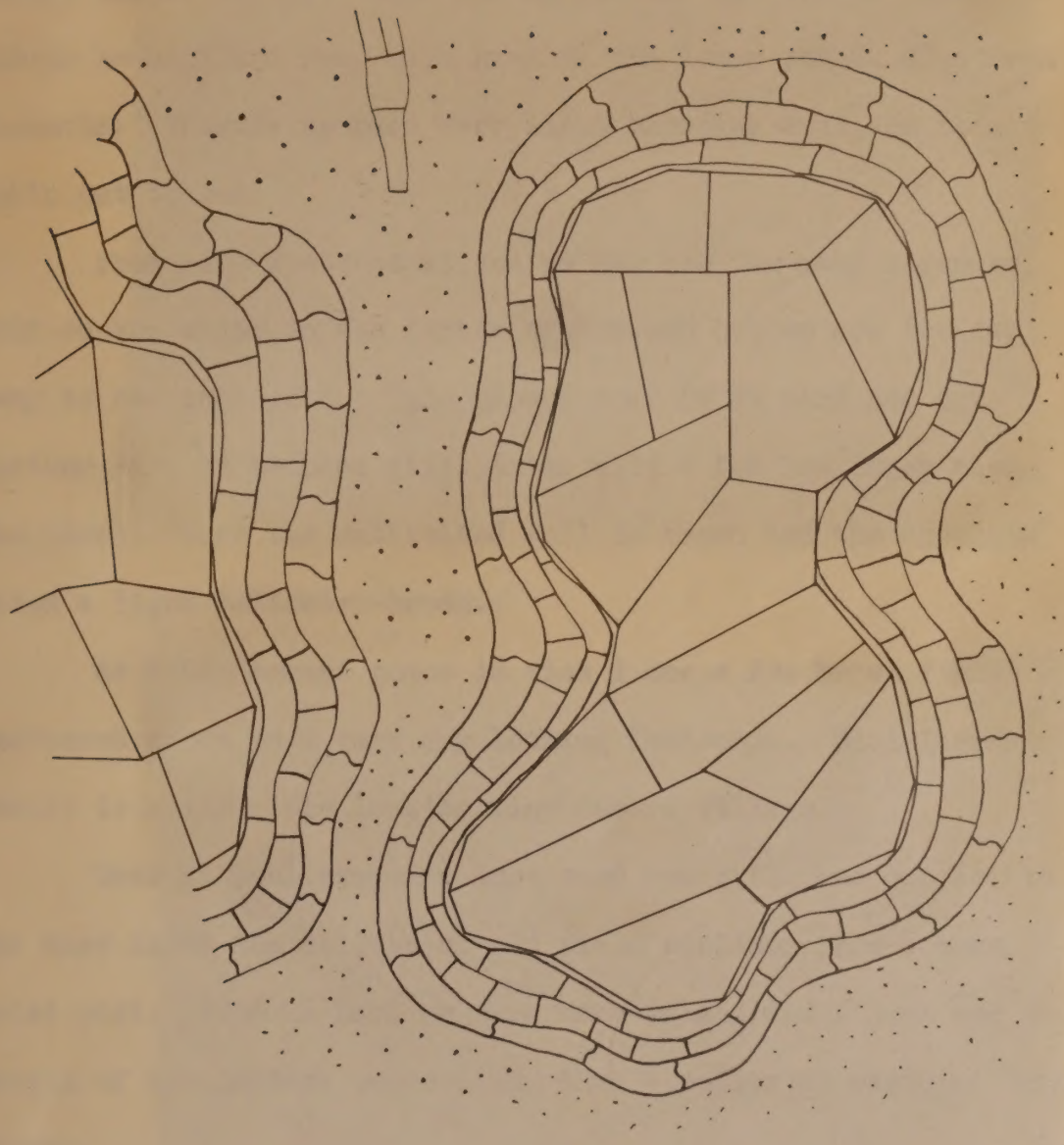

Schematic outline of field pattern of cultivated hill tops and a narrow valley, west of Ain el Gazala

uncultivated areas there are streaks on the land that probably indicate old field lines where the land was used before the Sahara became so dry. Near Ain el Gazala the soil is nearly barren -- hard and red, with gray in the lower strata of stream channels. Shortly we pass over light brownish soil and then again out to sea.

From some distance at sea we can see the many stranded, half sunken ships in the harbor of Tobruch but we are too far away to see much of the land except that it is hard and dry. Farther east it becomes still drier with a few low dunes along the shore. Here the cultivated soil is brown and the uncultivated a light yellowish-brown.

As Sidi Barrani comes in view I see a few brown fields scattered about in a very dry looking landscape. Sidi Barrani itself is a miserable looking tiny desert village.

Near El Dabá there is more sand but still one can see in the hard lands the relicts of old field outlines from a more moist past. From El Dabá we turn more inland and I just see the margin of the Qattara Depression, then a yellowish waste of true desert.

The pilot circles gently over the pyramids and then across the Nile to the airfield. One is always tremendously impressed at the extreme contrast in Egypt between the yellow desert and the green densely populated delta.

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K-1351 May 31, 1947
Egypt. Pyramids.

K-1506 May 31, 1947
Egypt. Nile delta between Pyramids and Cairo.

K-1351 May 31, 1947
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K-1506 May 31, 1947
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We are down at 3:30. There are some delays in getting into the bus on account of customs. Apparently the Egyptians want to impress us with their sovereignty. I am assigned room 205 in the Continental-Savoy Hotel. I take a brief walk in the streets but don't like Cairo any better this time than I did before. These Arab salesmen need to be insulted before one may walk in peace. But, of course, such a motly assemblage of things -- people, dress, and language -- is always interesting. I have a good dinner but I would give a lot for a pitcher of good "safe" American ice water. My room is terribly hot, so as I go to bed I leave the door open and hope for the best.

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The Continental-Savoy Cairo

فندق الكونتيننتال سافوى القاهرة

Diner à P. T. 40

عشاء ٤٠ قرش

Velouté Montespan
ou
Consommé Gacé en Tasse au Sherry

شوربة اسبارا جوس
أو
ربة مثلجه بالشيرى فى الفنجان

Goujons de Soles Frits
Sauce Remoulade

قطع سمك محمر
صلصه

Mignon de Veau Sauté Beaulieu
Fond d'Artichauts
Pommes Parisienne
Petits Pois & Carottes à la Crème

لحمه محمره
خرشوف
بطاطس باريسيه
بازلاء وجزر بالكريمه
سلطه الموسم

Salade de Saison

Coupe Viennoise
Sablés
ou
Corbeille de Fruits

مثلجات بالقهوه
حلويات
أو
سلة فواكه

31 Mai 1947

٣٠ مايو ١٩٤٧

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CAIRO : Shepheard's Hotel - Semiramis Hôtel
The Continental Savoy
PYRAMIDS' Mena House Hotel

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NEAR THE PYRAMIDS OF GIZA

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MARBLE SWIMMING POOL,

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9 HOLE GRASS GOLF COURSE,

3 TENNIS COURTS.

TUNISIA PALACE HOTEL

TUNIS

R. TUOR Prop.

Vendredi 30 Mai 1947.

MENU

du
DINER

-

Consommé Madrilène

-

Rougets Sautés Grenobloise

-

Noix de Veau poelée

-

Pommes Rissolées

-

Haricots verts frais au beurre

-

Coupe glacée Vanille

-

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Six Pages P.T. I

The Egyptian Gazette

ذی اچبشیان جازیت

68th. Year No. 20,117 Sunday, June 1, 1947

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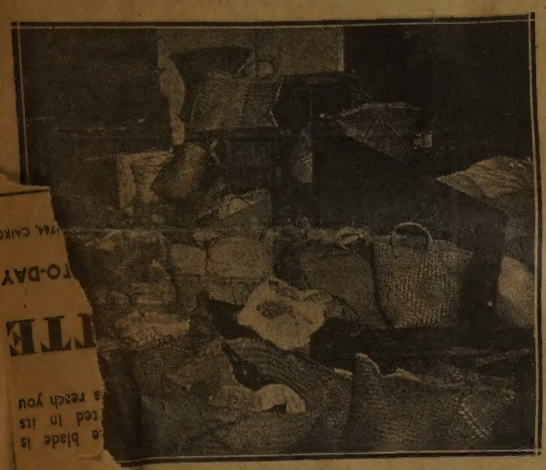
Dept. 19 B., 40, Sh. Malika Farida, Cairo.

After 20 years of exile in tropics, Riff rebel breaks parole and slips out of French hands

ABDUL KARIM SEEKS REFUGE IN EGYPT



Allowed to land, but told 'Keep out of politics'

BY «GAZETTE» REPORTERS

ABDUL KARIM, notorious leader of the Riff Rebellion, broke parole yesterday and landed at Port Said, slipping out of French hands after 20 years of close custody on tropical Reunion Island.

"I appeal to Al Faruk for refuge," the 67-year-old Emir wrote in a shaky hand in the Visitors' Book at Abdin Palace on his arrival in Cairo last night.

The Government has allowed Abdul Karim to stay in Egypt as long as he keeps out of politics, Nokrashy Pasha, the Prime Minister, told "The Egyptian Gazette" late last night.

M. Gilbert Arvengas the French Ambassador had just left after a 40-minute visit.

Meanwhile, El Emira Fawzia, Egyptian coastguard cruiser taking food to the famine-stricken people of Tunisia, was lying off the North African coast awaiting instructions from Cairo after being warned by the French against putting in at any Tunisian port.

A statement issued at the Quai d'Orsay last night condemned Egypt for "this failure to appreciate the most elementary usages of international courtesy".

Not free

Abdul Karim was sailing aboard the British ship "Katoomba"; he was going to France, where he had been allowed to live on parole.

At Suez last Wednesday, he told reporters who interviewed him that he would like to live in Egypt, he explained that he was not yet free man, although released from the prison island.

Yesbut...

Early yesday morning, when the Governor of Port Said went on board to get him on behalf of the Egyptian Government, he asked for permission to land and live in ypt.

The Primdinister, who was consulted bytelephone, gave it on conditionat Abdul Karim should keep of politics.

Speal bus

At 6.30, a ecially chartered bus drove in Cairo with the Emir, his eln children, wife, brother, unc and their servants. Seve lorries brought 60 pieces ofggage and the coffin of th leader's mother, who is beinonveyed home to Morocco forrial.

Prection

Abdul Km immediately drove to AbdPalace, where he wrote in thesitors' Book:

"I have honour to greet His Majesti Faruk and beg his protect after 20 years of exile.

"God Sa Al Faruk, defender of Islm and Islam."

Risong

The wholemily then went to the Moor youth hostel in Garden City where a large crowd of stuts sang the Riff anthem, he for the first time since he desert battles that massad some 50,000 Spanish andrench troops.

Exiled No African leaders and Egptia rushed around the Emir, w wearily drank a glass of orgeade.

Letne rest

He wore loose white turbin, green burnose and yellow slippers.

His beard was grey and stubby, but his deep-set small eyes twinkled with pleasure.

Suddenly he rose, his face linked across the room and dissed the crowd with th words:

"I am tird; I need a rest."

Minus yellow ring

Red, white and blue ring painted on Royal Air Force planes before the war are to return, but the yellow ring will disappear. (SS.)

THE FACE OF A REBEL

THE FACE OF A DESERT WARRIOR: Abdul Karim as he looked last night on his arrival in Cairo. Tired and 67, the rebel leader still has an alert expression. This is one of the first pictures taken of him since he went into exile 20 years ago.

'Dock in France, we'll see that it gets to Tunis'

Paris, May 31.

FRANCE has sharply criticised the Egyptian Government today for sending a 320-ton gift shipment of wheat and rice to Tunisia on a cruiser and said the ship would not be permitted to land in a Tunisian port.

However, "to avoid an incident," France will accept the wheat if it is transferred to a French ship in some other French port, the Quai d'Orsay added.

The French statement charges the Egyptian Government with a "disregard of the most elementary usages of international courtesy in sending the cruiser Emira Fawzia (2,640 tons), on its mission from the Egyptian Red Crescent.

France says the wheat was not needed and that the Tunisians are not starving.

The French say that on April 19, Egypt asked permission to send two military planes to Tunisia with 12 Army officers and a Red Crescent mission apparently because of what the French say, were unfounded reports that certain parts of Tunisia were suffering a famine.

France accepted such a humanitarian gesture only to see ensue a "Violent Press campaign in Egyptian newspapers accusing France of starving North Africa."

The Quai d'Orsay says that on May 14 an Egyptian newspaper announced that a Red Crescent mission would leave Port Said on May 17 on a Royal Marine cruiser for Tunisia, with 250 tons of cereals and 70 tons of rice, "bought with funds from a public subscription."

The statement continues:

Fait accompli

"The French Government which had not been advised of that new mission noticed the manifestly political character given to the whole affair and made known that it could not possibly accept such a fait-accompli in authorising the landing of the Egyptian ship.

"However, wishing to avoid any delay in the Red Crescent gift reaching Tunisia, the French Government told Cairo that instructions had been given for a French ship passing by Alexandria to pick up the cereals in question and transport them to Tunisia.

She's gone

"The affair appeared to be settled.

"But on May 27 the French Ambassador in Cairo was told by the Egyptian Minister of Foreign Affairs that the cruiser Emira Fawzia had left Alexandria the day before to Tunis.

"Before that disregard of the most elementary usages of international courtesy, the French Government could only maintain its position in telling the Egyptian authorities that the cruiser in question would not be admitted in a Tunisian port."

Too late

The French statement says that last Wednesday the Egyptian Government asked France for permission to send the ship to Tunisia the second week in June but that the ship actually arrived off Tunis yesterday.

The Egyptian Government had not been able to notify the ship's commander, the French said, adding:

No delay

"Animated by a desire to avoid an incident and to reply to the sentiments of the Egyptian donators, the French Government has proposed to the Government in Cairo to unload the cargo in a French port from where it will be sent without delay to Tunisia by the French merchant marine."

"There is no famine" in Tunisia, the Quai d'Orsay says, pointing out that the French Parliament recently allocated 630 million francs for free food distribution to Tunisians hard hit by drought.

"I AM SO TIRED..."

ABDUL KARIM, sipping a glass of orangeade, hears the latest news from El Sayed Mohamed Abbud, an exiled Moorish leader. Picture was taken shortly after the Riff leader's arrival in Cairo yesterday evening. He later told his visitors: "I am so tired".

"We respected his word," say French

Paris, May 31.

THE landing of the former Riff leader, Abdul Karim, at Port Said today while enroute from exile on the Island of Reunion to Marseilles, has caused the French government "very great surprise," a spokesman for the French Foreign Ministry stated tonight.

He added that the French Government's decision on whether to take diplomatic action, and what nature such action would have, would not be taken until a full report of the sudden unexpected landing of the Arab leader in Egypt is received.

Explaining the French government's attitude towards Karim, the spokesman said: "In 1926, when Karim surrendered to the French Army, he pledged himself to remain under French custody and he has always been extremely correct in his attitude.

"We have always accepted and respected his word of honour, given ten years ago," the French spokesman continued, "and after his very gallant attitude during the past years toward- France, his breach of faith today has caused us very very great surprise."

"When he applied for residence in France so that his sons could receive a French education," the spokesman said, "the government decided last February to allow him to do so."

Never again

After Abdul Karim's capture in 1926, the French government agreed with the Spanish Government to keep Karim in custody and prevent him from ever again attempting to stimulate revolt in North Africa.

Asked if any official reaction were expected from the Spanish Government over Karim's landing in Egypt today, the spokesman said: "The Spanish Government may very probably send a protest to Egypt and may inquire of France how Karim's landing was effected." (Reuter)

It started with a slap

ABDUL KARIM is a member of the renowned Beni Urriaghel family and caught the world's imagination in 1921 with his victorious leadership of the Riffs in sharply contested guerilla warfare against numerically superior Spanish troops in Morocco.

The story goes that at one time he was strongly pro-Spanish and that he took his degree of Doctor of Laws at Madrid University.

Later he had a quarrel with a general; the general slapped his face and Abdul Karim, the rebel, was born.

Later, he captured the general in battle and took revenge by having him beheaded..

No grudge

In 1926, after an unequal struggle, he surrendered to the French and he set out to exile on the Isle of Reunion, assuring everybody that he bore no resentment against the French.

His recent release was regarded by Spain as a breach of treaty undertakings, but a protest by General Franco met with the reply that the treaty was signed by the Spanish Republican Government which he had overthrown and repudiated in the Civil War of 1936-39.

CAIRO PRESS INDIGNANT

GREAT indignation is expressed in the Arabic Press over the refusal of the French to allow the Fawzia to enter Tunis.

When 100 miles out from the port, the coastguard cruiser was sighted by a French naval aircraft.

After circling over her for a while, it flew back.

A short while later, the ship's wireless received a warning from Tunis. The skipper was told that he would be allowed to get provisions if he entered the port.

The Press says.

On board of the ship are Dr. Mansur Fahmy Pasha, and Dr. Abdul Halim Mahfuz Bey, representing the Red Crescent Society.

Pupils paint school

Pupils of King Edward VI School, Macclesfield, Cheshire, gave up a holiday to paint the outside of the school. (SS.)

12 nations to help Europe

WILL REPLACE UNRRA

Lake Success, May 31.

ONLY 12 of U.N.O.'s 55 nations have promised to help European states no longer receiving help from U.N.R.R.A., which is in process of being wound up.

They are Britain, United States, Soviet Union, France, Australia, New Zealand, Czechoslovakia, Denmark, Norway, Poland, Yugoslavia and Sweden. None of the Latin American countries has so far reported plans for helping needy European states.

The present position, according to latest United Nations reports, is that a minimum of 583,000,000 dollars is required to aid seven European countries.

The United States Congress has approved authorisation for 350,000,000 dollars for relief, but this is expected to take a few weeks to pass through administrate machinery.

Britain has offered 40,000,000 dollars in grants and loans to

The movement of carefully selected European labour to Canada — a government immigration experiment — is expected by observers at Ottawa to become a Parliamenatry issue.

Arrangements have been made already for the immigration of hundreds of displaced persons and thousands more are being considered as potential immigrants.

Political quarters believe that the policy of the new government will not bring any radical change to the situation, except that the electoral campaign for furtherance of Left-wing ideas will be launched preparatory to the elections in early autumn.

Communist and Socialist newspapers today made violent attacks on M. Nagy, who was accused to have been incriminated in a plot "against Hungarian Democratic institutions" in evidence given to the Russian police by M. Bela Kovacs, Secretary-General of the Small-Holders' Party, now under arrest.

Wants his boy

The Social Democrat "Nepszava" spoke of the need to "but an end to this cheating game." It also said that worker's parties wanted to form a new coalition cabinet and to secure the cooperation of "all true Democrats from the Small-Holders Party."

Meanwhile, M. Ferenc Nagy, the former Premier, this morning telephoned from his hotel in Berne to Budapest in order to come to an arrangement with the authorities there concerning his five-year-old son, who stayed with his grand-parents when his parents left the country.

The Hungarian authorities sent the boy to Switzerland tonight accompanied by a governess. (Reuter)

SMALL-HOLDER LEADS NEW HUNGARY GOVT.

Budapest, May 31.

LAJOS DINNIES, 64-year-old former Minister of War and member of the Small-Holders' Party, formed the new Hungarian Government which was sworn in tonight.

The only change in the Cabinet, besides the premiership, is the appointment of Istvan Kertesz, Minister to Rome, as Foreign Minister, replacing Janos Gyongyos, whose pro-Anglo-Saxon views have been opposed by left-wing parties.

This decision followed the dramatic resignation by telephone from Switzerland last night of former Premier Fereng Nagy, who said he would on no account return to his country at present, after the Russians had accused him of an anti-Soviet plot. The Cabinet also decided today to [illegible] Hungarian [illegible] and national Labour bodies have described it as a "slipshod method" of circumverting the Truman immigration policy.

Replying to criticism, the Labour Minister, Mr. Humphrey Mitchels, said in an interview, "There is not going to be anything done in the way of the immigration of labour which will injure the wage structure of this country."

Anti-Francoist gets 6 years

Alcala De Henares, Near Madrid, May 31.

[illegible] France [illegible]

Six other men received sentences ranging from two to four years.

King wins dog prize

The King won a prize for the best yellow labrador in the dog show at King's Lynn. (SS.)

India's Big Five invited to formal conference

New Delhi, May 31.

THE VICEROY, Lord Mountbatten, tonight formally invited India's "Big Five" political leaders to meet him on Monday to hear the British Government's final plan for transferring power to Indians as nation-wide eve-of-conference precautions were being taken to prevent further disorders.

The five are: Pandit Nehru, vice-President of the Interim Government; Sardar Vallabhai Patel, Minister of Home Affairs, (both Congress Party men); Aly Jinnah, President of the Indian Moslem League; Liaquat Aly Khan, Minister of Finance and Secretary of the League; and Sardar Baldev Singh, Sikh Minister of Defence.

Police riot squads in New Delhi will be issues with bren guns and other military weapons tomorrow, and troops [illegible] in the city as part of the measures to control lawlessness.

Meanwhile, reliable sources says that gun running from the turbulent North West frontier and Burma into India and the conversion to the Indian states into armed camps full of weapons of all descriptions are becoming commonplace.

Jeep ban

Jeeps have been purchased in large numbers and are being driven into the Indian States

The Chief Commissioner of New Delhi has placed a ban on driving jeeps in the province for one month.

In Burma

In Burma, troops were manning Rangoon police stations today while the authorities rounded up "rebel" leaders of the Police Union, whose activities led the Government to order the disarming of the entire city police force last Thursday "to prevent incidents."

Detectives are combing the city and suburbs for U Wan Maung, leader of last year's police strike.

"Don't show off"

"Don't show off to your girl as you drive" the Hon. Humphrey Lagge, Berkshire Chief Constable, warns young motorists. (SS.)

5,000 MORE WALK OUT IN CEYLON

Colombo, May 31.

FIVE THOUSAND clerks in Government departments walked out today as protest against the order of the Ceylon Chief Secretary, C. H. Collin's withdrawing recognition of the Government General Clerical Service.

The walkout paralysed work in Government departments. In all approximately 16,000 workers are now on strike in the city. Work in the city warehouses is at a standstill.

The strikers include the oil workers whose walkout has caused a critical shortage of petrol.

Police with batons charged a group of strikers who attempted yesterday to stop lorries carrying oil for use in buses. Several persons including one Municipal councillor were seriously injured. — (A.P.).

U.S. CRUISER SINGAPORE

Singapore, May 31. — The U.S. Navy heavy cruiser, Singapore, arrived in Singapore today. Captain A.J. Detzer relieving Rear Admiral Egerton, Flag Officer, Malaya, aboard the cruiser, warned their men of the dangers of Singapore gangsters. Most of the sailors were ashore here. — (AP).

DE GASPERI NAMES NEW ONE-PARTY CABINET

Rome, May 31.

SIG. ALCIDE DE GASPERI'S fourth cabinet, the first since the liberation of Italy to exclude Communists and Socialists, was ready late today for presentation to the provisional President, Sig. Enrico de Nicola.

The list of Cabinet members — containing 11 Christian Democrats and five independents — was officially announced by Paolo Cappa, Christian Democrat, outgoing under-Secretary of the Presidency and Minister of the Merchant Marine in the new Government.

Italian workmen were quiet this afternoon, as the new Cabinet — minus representatives of the Left — was announced, but the Leftist Press continued its attacks.

Rome's Socialist "Avanti" declared that "The Government is one that must be overthrown immediately."

The Christian Democratic leader De Gasperi, for the fourth consecutive time heads the Government as Premier.

Its other members are:

Vice-President and Minister of the Budget: Luigi Sinaudi, Independent. Bant of Italy Governor.

Foreign Affairs: Count Carlo Sforza, Independent.

Interior: Mario Scelba, Christian Democrat.

Finance: Ezio Vanoni, Christian

National Defence: Mario Cingolani, Christian Democrat.

Education: Guido Conelli, Christian Democrat.

Public Works: Umberto Tupini, Christian Democrat.

Justice: Giuseppe Grassi, Independent.

Agriculture: Antonio Segni, Christian Democrat.

Transport: Guido Corbelli, Independent.

Post and Telegraph: Umberto Merlin, Christian Democrat.

Industry and Comerce: Giuseppe Togni, Christian Independent.

Labour: Amintore Fanfani, Christian Democrat.

Foreign Trade: Cesare Merzagora, Independent, who is now in Brazil representing the Italian Government in economic negotiations.

Merchant Marine: Paolo Cappa, Christian Democrat.

There were reports in Government circles that Pietro Campilli, Christian Democrat out-going Minister of the Treasury would be given a foreign assignment conneced with efforts to bolster the Lira which during the past crisis fell to as low as 850 lire to the dollar on the open market, compared with the official rate of 225. (AP.)

U.S., Turks divide funds: 80% for war, 20 for roads

Ankara, May 31.

THE Conference between American and Turkish military presentatives on the application of United States aid fur to Turkey is nearing its inclusion.

Though nothing has yet been disclosbout the distribution of Unit States funds for military a economic expenditure, well-informed quarters said th 80,000,000 dollars will be use for military purposes and 20,000 dollars for the construc of ports and roads.

Notorious

It was reported at Ankara that the modernisation of some Turkish ports on the Eastern Mediterran and the construction strategical roads Mediterranean, Anatolian coast and the Black Sea have been decided on.

United States experts, headed by Major-Gen. Lunsford Oliver, intend to tour the country, probably beginning next week, to complete their investigations into Turkey's military, industrial and economic requirements.

Meanwhile Moscow Radio said today:

"Arab political circles feel that Turkey's move to establish closer relations with the Arabian countries is closely connected with Anglo-Saxon plans for the notorious Eastern Bloc."

"This Eastern Bloc is a camouflage by the Anglo-Saxons to bring the whole of the Near East under their political, economic and military control."

The chief role in this control was assigned to the United States, Moscow radio added.

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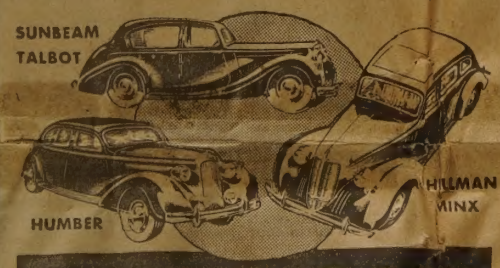

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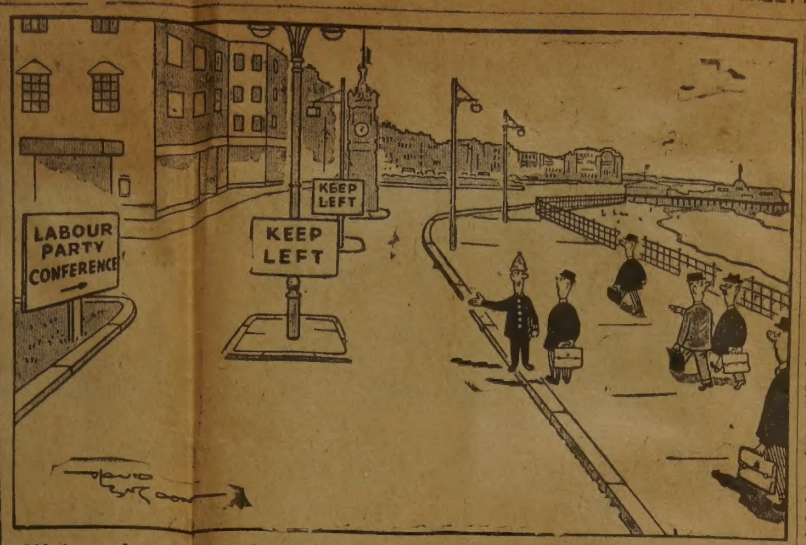

"We've always had them 'Keep Left' signs in Margate, sir. Nothing to do with the Conference..."

Briton feels pinch of dollar shortage

by Our London Correspondent

IF the British people had any doubts about the gravity of what is commonly known as the "dollar shortage" these were pretty smartly removed by the sharp increase in the duty on tobacco and cigarettes.

Unfortunately they give by no means heard the last of the elusive dollar, for Mr Hugh Dalton, the Chancellor of the Exchequer, has plainly warned that the tobacco cut will not be the last, and that some further unpleasantries may be expected.

For some months past there has been concern in business and financial circles at the rapid rate at which Britain is using up her American loan. It is true that some of the drain has gone to food imports, and that the hard currency value of the loan has reduced by about 40 percent.

Even so many eyebrows were raised sharply when it was learned that nearly half the loan has been used and that, at the present rate of withdrawals, it will not even last to the end of 1948, as previously anticipated.

Reaction

There have been various reactions to this news. Important talks are said to be going on in Whitehall (though one gathers talks in Whitehall are always important anyway), and it has been rumoured: (1) that Britain will ask America for a new loan, (2) that Britain won't ask but that Mr. Lewis Douglas, the American Ambassador will ask for her, (3) that the Cabinet has been reviewing the whole of the dollar expenditure and that Mr. Dalton will have some cuts to announce shortly, and (4) that a new economic mission will be leaving Britain for America this summer.

Somebody has been at pains to deny "officially" that Britain will ask America for another loan, but whether she does so or not it requires very little imagination to appreciate that the country's finances are difficult, and that, while the trade figures for April were "better than expected," they still hadn't shaken off the winter chill.

With Britain having to make her sterling freely convertible into dollars on July 15, with sluggish production figures threatening to continue, with the necessity of using dollars to meet her obligations in Germany, and with half her American loan gone... It is such reasons as these which convince many people that Britain must have another loan, or a gift — but at any rate dollars — whether she does the asking for not.

Naturally the House of Commons has been brooding over this subject among many others.

Functions

Though London is by no means her pre-war self, many of the pre-war functions and engagements are gradually creeping back. For instance, in past weeks we have been the return of the Ideal Homes Exhibition and the British Industries Fair. Now the famous Chelsea flower show has blossomed bravely again, and included the first exhibition by the King since 1912 — a fine array of "poor-man" orchids from Windsor.

Next on the list is the revival of two of London's spectacular military displays on June 12, the King's official birthday. In the morning His Majesty will inspect the Brigade of Guards on the Horse Guards Parade and attend the ceremony of Trooping the Colour. In the afternoon he will open the Royal Tournament at Olympia.

Trooping the Colour was, in pre-war days, one of the most attractive of London's military events, when the guardsmen turned out in their bearskins and scarlet jackets. There will, however, be neither this year. Battledress will be the order of the day, for the ceremonial uniforms are still stored away with liberal quantities of moth balls to keep them company.

Judging by an incident which occurred this week, it seems that doctors don't have a monopoly of bad writing. The Bishop of Chelmsford, Dr. Henry Wilson, became agitated when he found that he was unable to read a "squiggle" on his diary. He knew that he had an appointment to keep on a certain date; but for the life of him he couldn't decide where it was, for he could not read his own writing.

Being a man, like Kipling's mariner, "of infinite resource and sagacity" he appealed to the Chelmsford Diocesan Chronicle to help him in his predicament. Several national dailies also came to his rescue and it was discovered that his engagement was to take a service at a girls' school at Clacton.

Said the Bishop: "I'm so glad it's settled. I've been answering the 'phone every five minutes."

This beautiful orchid named after Princess Elizabeth was the highlight of the Chelsea flower show last week. (Reuter)

Sitting on the Fence

By NATHANIEL GUBBINS

"WHERE are we going for our holidays?" asked the Sparrow's wife, glancing up from her little bit of knitting.

The Sparrow roused himself from a nap to glare at her with one beady eye.

"Every year since we've been married," said the Sparrow, *"you've asked exactly the same question at almost exactly the same time of the year."*

"Well, it's the proper time to talk about summer holidays, isn't it?" asked his wife.

"Roughly about the middle of November," said the Sparrow, *"you ask what are we going to do for Christmas. At the end of February you ask what are we going to do for Easter. Towards the end of May you ask where are we going for our summer holidays. It's like living with a calendar."*

"I'm sure I don't know what you're talking about," said his wife.

"Unfortunately," said the Sparrow, *"I always know what you're talking about. And what's worse, I always know what you're going to talk about. I know what you're going to say in any given circumstance."*

"Such as what" asked his wife.

"When I go out in the morning," said the Sparrow, *"you say: 'If you can be good be careful.' When I come home you say, 'Had a nice day?' If I am silent for two minutes you say, 'Is there anything wrong?' If I sneeze you say 'Bless you. When I said living with you was like living with a dendar, I was wrong. It's like living with an old gramophone record."*

"Oh, how could you?" asked his wife, a tear starting in her eye. "Fancy calling your wife an old gramophone record."

"I knew you'd say that, too," said the Sparrow, preparing to leave.

"Where are you going ?" asked his wife.

"And that," said the Sparrow. "To that awful Tree Tops Club?"

"Touché," said the Sparrow, flying straight to the Other Sparrow's Nest.

At the Other Sparrow's Nest it was cocktail time. The Other Sparrow, her beak and claws crimson with lipstick and varnish, was lying on a little settee before a tiny, twinkling fire.

"Hullo, Faster Than Sound," said the Sparrow, sitting down beside her.

"Hullo, Jet Propelled," drawled the Other Sparrow. "Have a drink."

"Thanks," said the Sparrow, helping himself. *"Where are we going for our holidays ?"*

"You say that about this time every year," said the Other Sparrow.

"I mean let's go for good," said the Sparrow, *"away from it all."*

"You say that, too," said the Other Sparrow.

"But I mean it this time," said the Sparrow.

"And that," said the Other Sparrow.

"I can't live without you," said the Sparrow.

"Touché," said the Other Sparrow. "Forget it and have another drink."

"O.K." said the Sparrow helping himself to a double.

Fan mail

THIS week's letter from my persistent correspondent who always begins his letters "Dear Pig" is as follows:—

Dear Pig,

Among other things I hate about your article, is the way you print some lines in italics and some in ordinary print. Are the lines in italics supposed to be funnier than the others or what, because I don't think any of them are funny.

Well, dear Pig, for one I am in disagreement with you there. I [illegible] you that the printing [illegible] want to read it. I [illegible] these matters.

Nevertheless, I have my theories.

One is that the experts believe that readers are easily bored. Therefore they think that if alternate lines are printed in italic and Roman type the reader will at least be able to finish a paragraph without yawning.

Another theory is that the experts are nervous of anything that is not quite serious and are terrified that somebody might not see the joke. Therefore the italic lines may be printed as a warning "This is funny."

But so far as I am concerned dear Pig, they can print the whole thing upside down, if that would make it more readable.

In fact, if I were an expert in the production of newspapers I would do more daring things than that with funny columns.

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"Gazette" Short Story

THE TEEN-AGER

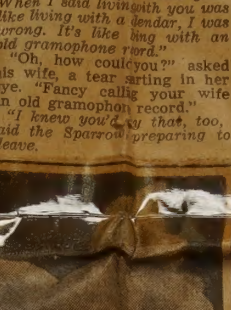
by Lina Iellman

SHE sat in the semi-darkness of her bedroom, her eyes dark with pain as she tried to figure out the cause for her mother's amazing behaviour that afternoon.

She hadn't done anything wrong, she was only trying to chat with her mother the way Joan did. Joan, her lovely sister, who was always being praised as the perfect young lady.

She had been asked time and again why she could not dress, look and act like Joan. That afternoon she had tried very hard to act like Joan; she had even given up playing pirates with Ginger so that she could stay at home and have a chat with her mother.

Joan and her mother seemed to have such a lot to talk about — the next new frock, the latest boy friend; what make up to use and so on, for hours on end. The family knew that she just could not get interested in all those things, so she had tried instead to get mother interested in things that fascinated her. That was how all the trouble had started. She had tried to tell her mother how to dissect a frog. Mother had screamed. Mother had fainted, and when she had come to, Mother had been shocked. She had been told to please go to her room and not to come down till tea time.



She had been terribly hurt that her mother had not understood her at all. She could not help it, could she, if her clothes always looked dirty, if she always seemed to have runs and holes in her stockings, if her hair ribbon was always slipping out of place?

Once, just to please her mother, she had tried very hard to become more clothes and beauty-conscious. The result had been, to say the least, disastrous. She had asked Joan very casually how she came to have such beautiful arched eyebrows. The answer had been "Tweezers, of course."

SENSATION

She had crept into her mother's bedroom and, on finding the tweezers, proceeded to "do" her eyebrows.

Two hours later she had come down to tea ready to be a sensation. She had not been disappointed. Her father had greeted her with the remark that although she seemed to be fully dressed, somehow, somewhere something was missing. On making a closer scrutiny of her face he had stopped in horror, his eyes glued to the spot where her eyebrows should have been. In their place were two faint pencilled lines. The left wouldbe eyebrow wavered a little as it reached the temple — as if in contrast with the right one effect gave her face a decidedly lopsided look. She had had quite a few embarassing questions put to her while her unfortunate eyebrows were growing again, and from that day on she swore never to do anything else to her face.

No, she definitely could not seem to get her mother's approval in anything she did. As a matter of fact she was sure that her mother loved Joan much more than her; maybe her father did too.

Maybe she wasn't their girl at all; maybe she was just a foundling and nobody wanted to tell her so as not to hurt her feelings.

She could not live in this house any longer. She would run away, and maybe she would fall ill, or something, and then these so-called parents of hers would hear of it and feel very guilty at having been the cause of all her troubles and sorrows. She'd run away this very minute.

GURGLING

A faint gurgling in her tummy made her look at the clock. It was just a quarter past four and Mabel would, at this very minute, be wheeling in the tea trolly piled high with hot buttered scones, cake and steaming tea. What a pleasant picture it all made in her mind — the fire crackling merrily; her mother knitting or reading, her cheeks flushed by the fire looking almost as young and certainly as pretty as Joan; any minute now Mabel would come to the foot of the stairs calling out that tea was ready; any minute now she would go downstairs and join in the fun and laughter. She would curl up in front of the fire eating scones till she would be ready to burst, feeling them warm and soft in her throat, but she couldn't go down to tea, she was going to run away. Maybe she would run away tomorrow. But maybe she wasn't foundling, maybe, deep down, her Mummy and Daddy loved her as much as they loved Joan, maybe she would not run away at all. That was a good idea. She wouldn't run away after all. There were no better parents in the world than her mother and father, there was no nicer home, there was no sweeter sister.

She got up from her window seat, her head high, her eyes bright and her cheeks flushed with the realisation that she too belonged and that she too was loved. She walked down stairs

Sunday Sermon

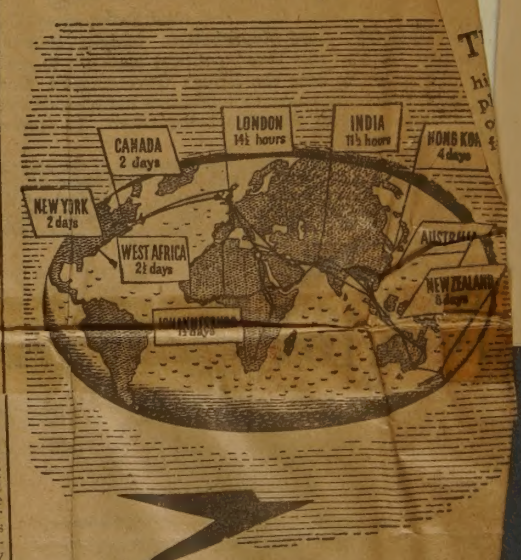
THIS problem of suffering is one of the age-long enigmas and has always raised the cry — Why? Indeed it has baffled the most spiritual men of our time and no one has yet really found a satisfactory answer. Are we then to be left in the dark on this subject? Has no religious Leader given us the key to suffering and as Christians have we not an answer to give to the world?

Yes, the word of God provides us with the answer and gives us the reason for all suffering humanity. In the main, the world suffers because of sin — Not so much as is supposed of Adams' sin, but our own sin, the sin of our own making Adam and Eve of course suffered because of disobedience and so do we today. Cain killed Abel because of jealousy and this is still done today and someone has to suffer. The children of Israel had to suffer heavily worship the molten calf, people still do that today worshipping the god of money and pleasure.

Secondly there are those who suffer quite innocently like Job of old of whom we are told he walked perfect before the Lord, but he suffered that his faith may be tried and he certainly would not give in although persuaded by a foolish wife whom he told off.

The New Testament of course as usual can help us a great deal for there we read of ONE who suffered the extreme agonies of the Cross and all who believe in Christ, have the privilege of suffering on His behalf as well. St. Peter tells us, "If any man suffer as a Christian let him not be ashamed but glorify God" which reminds us of the past martyrs and saints, prophets and priests who gave their life on the altar for God rather than deny their Eternal faith

Across the World from Ca



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June 1: Cairo to Khartoum

Up at seven after a warm and wakeful night. To breakfast at 7:45 and ready to go at 8:20 on the terrace of the Continental-Savoy. Today's paper has bad news. Egypt has just received and agrees to protect Abdul Karim, leader of the Riff Rebellion of 20 years ago. According to the paper, Egypt has sent a shipload of grain for the relief of drought-stricken Arabs in Tunis and the French say they may not land.

We get into the bus for the airport at 8:20 and it is already HOT, yet I feel fine, but likely I wouldn't if I stayed long in Cairo. As in Algeria, many of the natives wear heavy suits and topcoats in the blazing sun. We are in the air at 9:56 a.m. and fly east of the Nile over softly dissected, partly sandy true desert with dark rocks exposed on the sides of the arroyos and on some of the hilltops. Some 70 miles south of Cairo the Nile is not very wide, perhaps like the Wisconsin River near its mouth. The cultivated strip looks to be one to three miles on either side but we are rather too high to estimate accurately. The desert to the east is a dark brown dissected wasteland with sand only in the bottoms of the water courses. As we fly along I see many variations in relief, in the extent of dissection, and in the proportion of sand. When we are out 140 miles the Nile is too far to the west to see clearly. The sky is very hazy ahead and it appears that we are running into a

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K-1352 June 1, 1947
Egypt. Nile Valley near Cairo.

K-1353 June 1, 1947
Egypt. South of Cairo, looking east into true desert.

K-1352 June 1, 1917
Egypt. Nile Valley near Cairo.

K-1353 June 1, 1917
Egypt. South of Cairo, looking east into true desert.

storm; in fact, the plane is getting rocky but not too bumpy. The desert is barren except for a few scattered shrubs in the narrow sandy arroyos. This is in great contrast to Cairo with its teeming population. Then we pass through the storm -- no rain, only wind and dust. Although really not very rough most of the ladies are sick. In a few minutes we are in clear weather again. By chance, while we are passing through this storm, I come to an item in the morning newspaper describing the air accidents in the United States -- 53 killed in Maryland and a total of 175 killed in 48 hours from 9 crashes! Consoling!

Across the Nile near Sohâg we fly over the desert on the west side of the river. The land is completely barren. The plane is so rough that most are sick. Fortunately it doesn't bother me any. West of Aswân is a large area of desert with little sand and only slightly dissected. A few exposures suggest croûte calcaire, probably developed in a more moist period. Farther south there is considerable dissection with sand between the low rounded ridges. Even in this area there are places with only a little sand and large exposures of croûte calcaire.

Next we cross the Nile at El Dirr. At this point the Nile flows through the desert with almost no plants or habitations along the side. (The plane is still very rough and most of the passengers are exceedingly miserable.) In the Nubian Desert south of El Dirr there are many small sharp low hills, nearly

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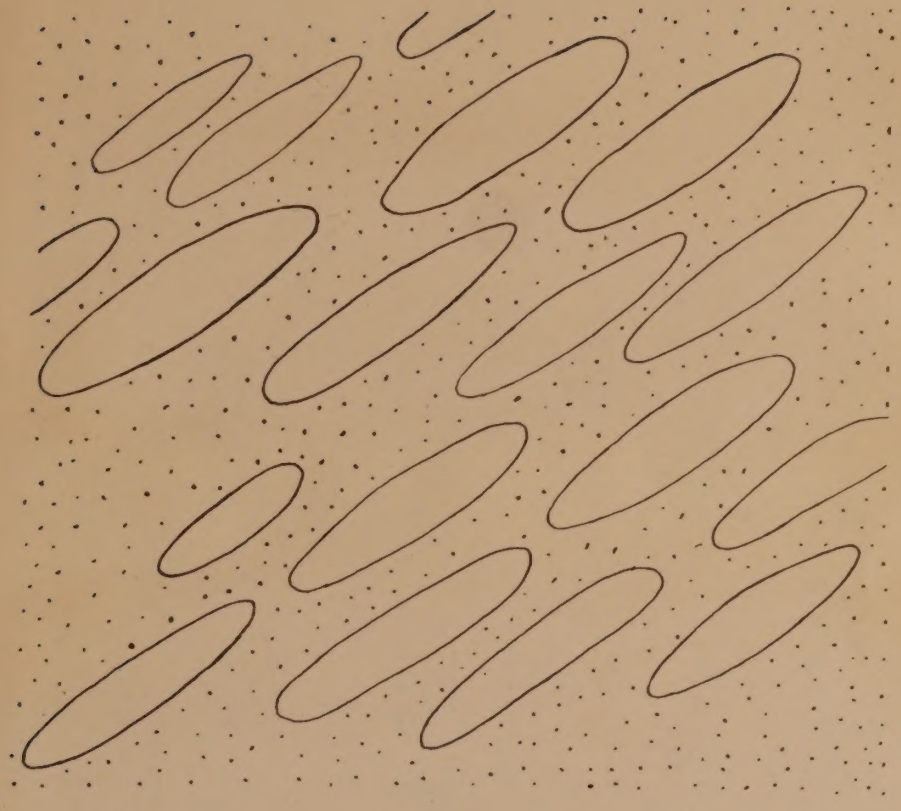

Schematic outline of sand
and rounded hills in desert south of Sohâg

K-1354 June 1, 1947
Egypt. Nile valley north of Sohâg.

K-1355 June 1, 1947
Egypt. Nile valley near Sohâg.

K-1354 June 1, 1947
Egypt. Nile valley north of Sohag.

K-1355 June 1, 1947
Egypt. Nile valley near Sohag.

black, surrounded by pale yellow sand. Farther on, in the Nubian Desert, I see large areas of sand waste more like the popular idea of desert than one usually sees. There exists no evidence of any living thing. Beyond the sands are a few ragged hills and mountains on either side of us and some wind-swept hardland. But the desert is mostly sand and certainly a wild place.

We cross the Nile again above the 4th Cataract. Here there is just a bit of farming along the river on very narrow first bottoms. Then the barren desert again. It is mostly medium-gray softly dissected hardlands with sand in the larger drainageways. As we go south there is more sand amongst low hills and rock outcrops. About 120 miles north of Khartoum it seems to me there is just a bit of vegetation, but I am not certain. A little farther on there are definitely some green plants on the surface. At 3:47 p.m. I just glimpse the Nile to the southeast. Near Khartoum we come to the confluence of the White Nile and the Blue Nile. This flight is nearly over. (Most of the passengers, and certainly our little stewardess, will be glad indeed.) As we approach the city there is a gradual increase in vegetation. And there is some farming along the river. Just before landing, I see some large brown wet spots.

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in the shade. In a few minutes another little squall comes up, like one I have just photographed. And it might have a drop of rain in it, but probably it's only sand. The mean rainfall is given as 5 inches.

This place reminds me of the Imperial Valley in Southern California. It is a great plain. In places I can see giant hexagonal cracks in the grayish-brown soil; other places appear to be wet.

We go to the Grand Hotel in a funny little bus made for quick people with very short legs. Most buildings are brown or gray and many of the houses have high walls around them. There are small trees along the streets. The place reminds me a little of Biskra but here there are street cars. It doesn't look too prosperous, but yet not too bad.

I check into the Grand Hotel (Room 17) and drive out in a taxi to Omdurman -- the native city. We go along the Nile, over a big steel bridge and on a good road. On the upper terraces the soil is very near to Red Desert. Along the Nile there is a narrow strip of heavy first bottom used for crops. It is irrigated by men operating buckets by hand to lift water to irrigation ditches. In the native city I buy a few gifts in the bazaars and start back for the hotel in a very bad dust storm -- locally called a "simoun". I take a sample of the dust

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K-1358 June 1, 1947
Sudan. Nile at Khartoum.

K-1358 - June 1, 1917
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as it settles on a table on the hotel terrace./a This storm lasts for a little over an hour. The sky is completely dark and dust fills every room and every cranny of the hotel. When it is over the air is slightly cooler. After a fair dinner I go to bed.

/a Added later: Dr. Humbert of our laboratory reported to me as follows:

The sample is a calcareous windblown silt with the following approximate mineralogical composition:

50% Quartz
15% Feldspar (Potash)
10% Mica
20% Aggregates - calcareous
5% Heavy minerals
Pyroxene
Amphibole
Epidote
Zircon
Garnet

The crystals are fresh and angular and are typical of windblown deposits from arid regions.

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June 2:- Khartoum to Stanleyville

Just after getting to sleep I am awakened at 3:45 a.m. It is still very hot. An English officer assures me that the water is pure -- I hope he is right! I drink deeply. At five o'clock in the morning it is already hot. After breakfast we go by bus to the airfield and there have customs, passports, and the usual delays. We get into the plane and it is terribly hot. Some say that the temperature here goes up to 160° Fahrenheit in the planes. It hardly seems possible. We pick up some more passengers, mostly women with small children. This will be bad if the plane is as rough as it was yesterday.

We are in the air at 5:57. As far as I can see to the east and southeast is a level plain along the Blue Nile. The White Nile is to the west of us. The soil appears to be dark brown and windswept with scattered low shrubs. But there are small native villages of mud houses, like those of the Arabs, out in essentially barren land. Here and there in the plain are small irregular shallow pools of water. I can see some field outlines but no crops because of the bright sun and a bad haze. Certainly there is very little cropping along the White Nile here. Even high in the air it is still hot.

After going south for some distance the land appears to be laid out in polygon-shaped fields for irrigation. Other parts are covered with thin shrub. I can see no crops, perhaps partly

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because of the haze and dust. I wonder if these are the "black cotton" soils of the Sudan.

About 70 miles out the land is not so level to the west. And 10 miles beyond, I can no longer see the level plains of the east. But there is only a little vegetation. As we go farther I see again some field patterns, irregular and angular, and villages sitting out in the hot sun. But still I can identify no crops or other vegetation.

We cross the White Nile at Ed Dueim. There are boats on the river. The field pattern near the stream suggests irrigation. But there are no crops now. The soil is nearly black with a few spots of gray. The cultivated area is narrow. Most of the first bottom along the Nile here is swampy for about two miles and covered with low vegetation. As we go south the soil becomes increasingly gray with black soil only in irregular strips. One sees markings like the Tundra landscape!

At about 150 miles there is more relief. The land is medium-gray, dark-gray, and brown, softly dissected, and nearly barren. I see a few dry-land field patterns and native villages. The amount of vegetation gradually increases as we go over low elongated grayish-brown hills separated by dark gray, nearly barren, flats. The uplands have many fields, apparently used for small grains. (It is so hot up here in the plane one wonders what the temperature must be on the ground!)

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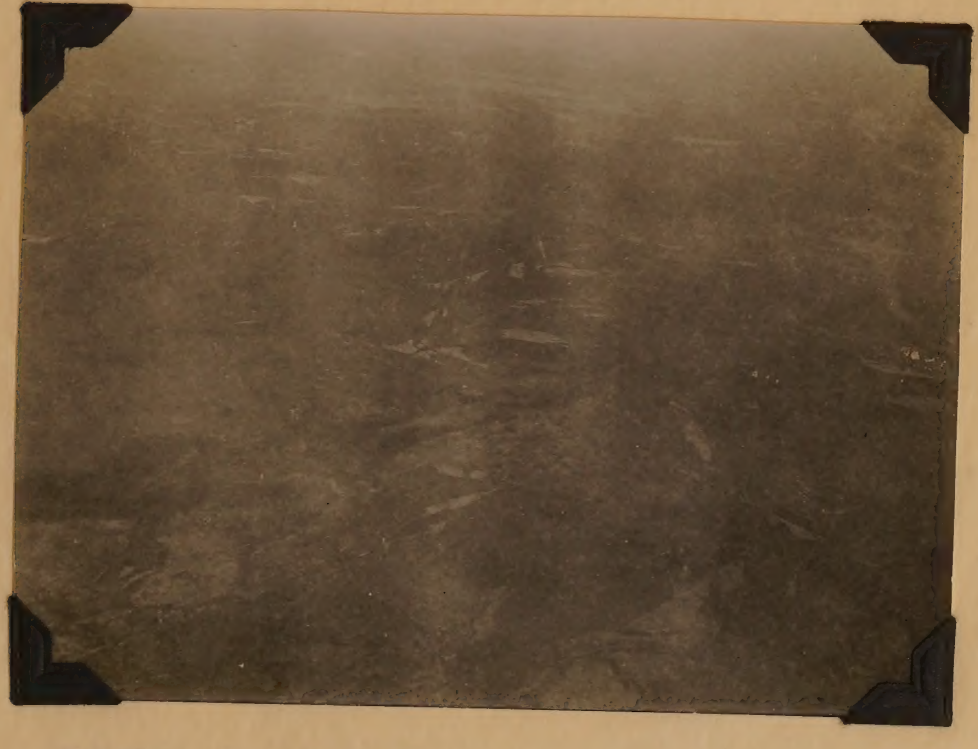
K-1359 June 2, 1947
Sudan. Nile near Malakal.



K-1360 June 2, 1947
Sudan. Great plain near Kongor.

IX.8
K1357

K-1359 June 2, 1947
Sudan. Nile near Malakal.

K1360

IX.8 IX.9

K-1360 June 2, 1947
Sudan. Great plain near Kongor.

At seven o'clock we cross an important highway, probably the one to Kosti. There are field patterns in the higher places with low walls marking the boundaries. Yet there are almost no fields on the dark gray land, but some tall grass or shrubs and trees. The pattern varies a great deal from place to place and we go for a long distance with no villages to be seen. For a hundred miles south of the Kosti Road the land has been smooth. The surface appears to be hard and I see one spot of exceedingly red soil, and a few tiny ponds, but no villages.

Then for a long way in the east I can see the White Nile. The land looks about the same, but gradually there is more vegetation, probably savanna.

Near Kaka there is a rather wide green first bottom along the Nile. Beneath the plane the soil is still dark gray with some bare spots, and an occasional very small pond, probably from recent rains. I can make out Kaka despite the haze and then barely see Melut. The land beneath the plane now is smooth and wet in places. We see the White Nile clearly to the east and soon will cross it again. For many miles to the west is a mottled, nearly flat, plain. Beyond Melut there are many ponds, channels, and marshy places between us and the Nile to the east. In a few scattered small clearings the soil here is nearly black.

At 8:18 we pass Malakal. There are flat marshy plains to the southeast above the Sobat River. Beyond, there is a slight

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relief in the plain. The lowest places are green and wet and the higher land is dark reddish-gray with quite a bit of cultivation in a weird pattern of green, brown, gray, and black. Now the plane is getting rough and it looks stormy out.

At 8:27 we cross the Sobat River. On narrow strips along the margins, likely natural levees, are some small villages and cultivated fields. A few miles farther I see many huts in the villages on the other side of the White Nile. Apparently there is considerable farming in the first bottoms. Soon we can see many scattered conical huts beneath the plane. The land has a complex pattern of green, black, yellowish-gray, and reddish-brown.

The sky to the southeast is very menacing and we have hard wind. But the plane is cooler and more comfortable now. About 40 miles below the Sobat crossing there are many little circular ponds in the plain below us. The savanna gradually becomes more dense. There are heavy clumps and areas of forest here and there. Near Duk Ayod there is a little native agriculture. To the southeast I can see for over a hundred miles across a broad low plain, and as far to the west as eye can reach. As we fly on there are several villages and scattered huts to be seen. But apparently only a little land is used for cereals. In the great plain near Kongor there are villages only along the streams, which are mainly a series of water holes. Here much of the plain has circular spots which vary from light gray to brown, and are probably

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old hut sites. There are very few trees.

About 9:30 we fly over an area with many little villages and some dark brown tilled fields. There is a dark olive green ground cover of savanna and a few scattered trees. To the west is a great marsh and a mass of channels of the Nile. There is a thickly settled native area where our route joins the river near Bor and Malek. The White Nile is dark brown where we cross it and the river shows typical post-maturity (like most of those in northeastern Siberia and Alaska!) with ponds, channels, oxbow lakes, and green wet marshes. The river is trenched very little into this broad smooth plain.

About 40 miles north of Juba we turn slightly toward the southeast. There are a few more trees. The soil in the fields is reddish-brown and there are numerous clearings on the higher land. But still it is mainly a level plain. We go nearly south along the Nile and turn a few degrees to the west at Juba. Here the Nile Valley is fairly narrow with gentle slopes down to the river from each side. There is more dissection and more spots of reddish soils. I suspect some accelerated erosion from over-grazing, but of course I can't be sure. The ground cover is mostly thin savanna and thin forest.

Thirty miles farther on our course, I see some sharp hills or low mountains to the right. We pass Gumbiri Mountain on our right (5741 feet). Here there is a very interesting landscape

old hut sites. There are very few trees.

About 9:30 we fly over an area with many little villages and some dark brown tilled fields. There is a dark olive green ground cover of savanna and a few scattered trees. To the west is a great marsh and a mass of channels of the Nile. There is a thickly settled native area where our route joins the river near Bor and Malek. The White Nile is dark brown where we cross it and the river shows typical post-maturity (like most of those in northeastern Siberia and Alaska!) with ponds, channels, oxbow lakes, and green wet marshes. The river is trenched very little into this broad smooth plain.

About 40 miles north of Juba we turn slightly toward the southeast. There are a few more trees. The soil in the fields is reddish-brown and there are numerous clearings on the higher land. But still it is mainly a level plain. We go nearly south along the Nile and turn a few degrees to the west at Juba. Here the Nile Valley is fairly narrow with gentle slopes down to the river from each side. There is more dissection and more spots of reddish soils. I suspect some accelerated erosion from over-grazing, but of course I can't be sure. The ground cover is mostly thin savanna and thin forest.

Thirty miles farther on our course, I see some sharp hills or low mountains to the right. We pass Gumbiri Mountain on our right (5741 feet). Here there is a very interesting landscape

with dissections of broadly sloping upland traversed by narrow ridges. Curious water gaps, stream capture, and the like, may be seen in abundance.

About 75 miles southwest of Juba the land is smoother -- less deeply trenched but still well-drained. There are a few low rocky hills to the south, between us and the Nile. Here the ground cover is thicker but the pinkish soil shows through. There seem to be no clearings of importance.

About 20 miles beyond I see quite a bit of farming. The soil in the fields is dark reddish-brown just at the Congo border. The open areas are apparently tall coarse grasses. The fields are irregularly geometric -- mostly rectangular -- and now have some young crops, possibly maize. The number of fields and roads increases as we go forward and the soil is dark red and dark reddish-brown. Beyond Dopa there are many round low buildings with dome-like roofs of several sizes placed in courts, most of which are circular. This area seems to have both "town and country"-- scattered farms and villages. Even in the most densely populated portions, one sees less than 2 percent of clearings from the air./a

About 30 miles beyond Dopa we pass a small cluster of European houses. The country is broadly a plain made up of small

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K-1361 June 2, 1947
Belgian Congo. A mile west of Sudan border.
Heavy population.

K-1507 June 4, 1947.
Belgian Congo. Gallery forest northeast of Goya.

K-1361 June 2, 1947
Belgian Congo. A mile west of Sudan border.
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Belgian Congo. Gallery forest northeast of Goya.

softly curved low hills. The land becomes more green as we go on. I can make out some maize and bananas. There are some cultivated trees that I can't identify. In places the soil is a bright red. The plain gets more bumpy with outcrops of granite (?) and at about 180 miles beyond Juba the land is quite rough although still broadly a plain with about one-quarter forest. The pattern is typically that of savanna with gallery forests ("galerie forestiere").

We are now flying quite low. I see a few large animals, probably antelope. As we go on there is more water and nice streams. On some of the hills the savanna is being cut. The well-worn roads are very red, suggesting laterite; they look like bloody gashes in the landscape. About a hundred miles northeast of Irumu the cover is about one-half to two-thirds forest with only a few clearings. I see an active gold mine. Then a little ways farther the cover is mainly forest. I see several fields of bananas, some of which are shaded while others are entirely open. About 15 miles from Irumu we pass the solid forest and come into open hilly land. Right at the margin I see a small herd of wild elephants. To the southeast is a broad range of mountains.

We are down at Irumu at 12 Noon on an old stream terrace at the edge of the Ituri River, the water of which is a deep red. The surface soil is a dark gray clay underlain by light gray and brown mottled clay with angular nut structure. In the lower part

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Near the airfield is a group of men cutting the coarse grass which grows 6 to 10 feet tall, apparently simply to burn it. It is warm here but not so hot as at Khartoum.

We are in the air at one o'clock on our way to Stanleyville. As we go west there is nearly solid forest on a broad hilly plain, cut with the orange colored river Ituri. Out a little ways I see both clearings and partial clearings with bananas, papayas, and other food crops. The view of the forest is simply gorgeous. There are many kinds of green, some orange, some brown, and here and there a dash of brilliant red. This color extends as far as eye can reach for miles and miles without end. Besides the forest trees, there are palms. We pass Mambasa and the same landscape continues.

(The stewardess, Mlle. Yvonne Seelenne, reminds me that it is all over if we have to land here. When she brings my port wine at lunch she says she has something special for me. And after lunch she brings me a whole bottle of ice cold champagne. Here we go again!)

Certainly there are enormous resources of wood in the Congo. We cross the Ituri River again as a dark brown tributary flows into the orange-red main stream. As we go on there is less relief. For a hundred miles I see almost no clearings. Certainly this would be a big woods to be lost in. Then beyond Pumba the

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land has more relief, but only for a short distance. All of it is covered with this gorgeously beautiful forest. The pilot is flying low so that I may have a good view of it. We cross the brown-colored Lindi River. I see a few villages and here and there a small clearing or trail, but mainly there is solid forest beneath the plane. As we approach Stanleyville the forest gets somewhat more open in places that are probably swampy. Several miles east and northeast of Stanleyville we pass some sharp hills and the breaks of the Tshopo River. There are quite a few clearings here, including a plantation with an airstrip, to which the pilot courteously dips the plane. Now I can see a main road from time to time and several clearings. Near Anjenje there are some plantations. To the west is a broad nearly level plain as far as eye can see.

I go into the co-pilot's seat for the landing at Stanleyville. We more or less follow the highway and see rising smoke here and there from land clearings. And then straight ahead the great Congo River comes into view. Now there are more clearings, especially near the roads. In a few minutes I also see the Lualaba River. There is no mistake about this being a steaming jungle. The pilot circles so that I get a nice view of Stanley Falls on the Congo and the Tshopo Falls. We are down at 3:22 p.m. in Stanleyville (elevation - 1400 feet, rainfall - 66.3 inches).

I am met by M. F. Jurion, Director General of INÉAC in

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the Congo. We take a little time at customs and then go to the post office to send a cable back to Washington. Then to my hotel - Sapec - to clean up.

At about five o'clock we start a little tour about Stanleyville. First we go down to the Congo River at Stanley Falls. Just below the falls is a complicated structure of slender poles and fish traps operated by the natives. One of them shows me a very large wide thick fish called Le Capitan. It gets its name because when the natives sold their fish in the early days to the river boats the big one was always for le capitan.

On this plain around the city about 30 percent of the surface consists of old termite mounds (termitieres) 8 to 15 feet high and about 20 to 30 feet in diameter. Near the city I see some fairly good looking native cattle -- Zebu -- with some crosses of Fresian and Shorthorn. I also drive out to the Tshopo Falls. The river is smaller but the falls are more dramatic than those on the Congo. Surveying work is already well advanced for developing a hydro-electric power plant on this site. The Stanley Falls are very much longer but the view is rather spoiled with the great mass of native fish traps. In both places the rock is a rather coarse-grained red sandstone containing some fine gravel. In exposures, it exists in large massive blocks. The soil here is a brown fine sandy loam over the rock. The soil is apparently developed from alluvium laid down over a strath terrace. The

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Belgian Congo.
Fish traps at Stanley Falls. (Commercial photo)

Fragment plate #1

171

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Stanley Falls (Complete)

Belgian Congo.

Fish traps at Stanley Falls. (Commercial photo)

soil is quite productive if the forest is carefully preserved. But if overcultivated, the savanna grasses come in and the soil becomes unproductive.

I notice around Stanleyville that practically all of the automobiles are American made.

Just before dinner M. Jurion informs me that I must take not less than one-half a gram of quinine per day while I am in the Congo.

After our little tour we have a nice dinner at the Pourquoi pas. My rooms at the hotel include a parlor, living room, bedroom, and bath, with nets over the bed. It will be hot but I am so tired I could sleep any place. This has been an interesting day without compare.

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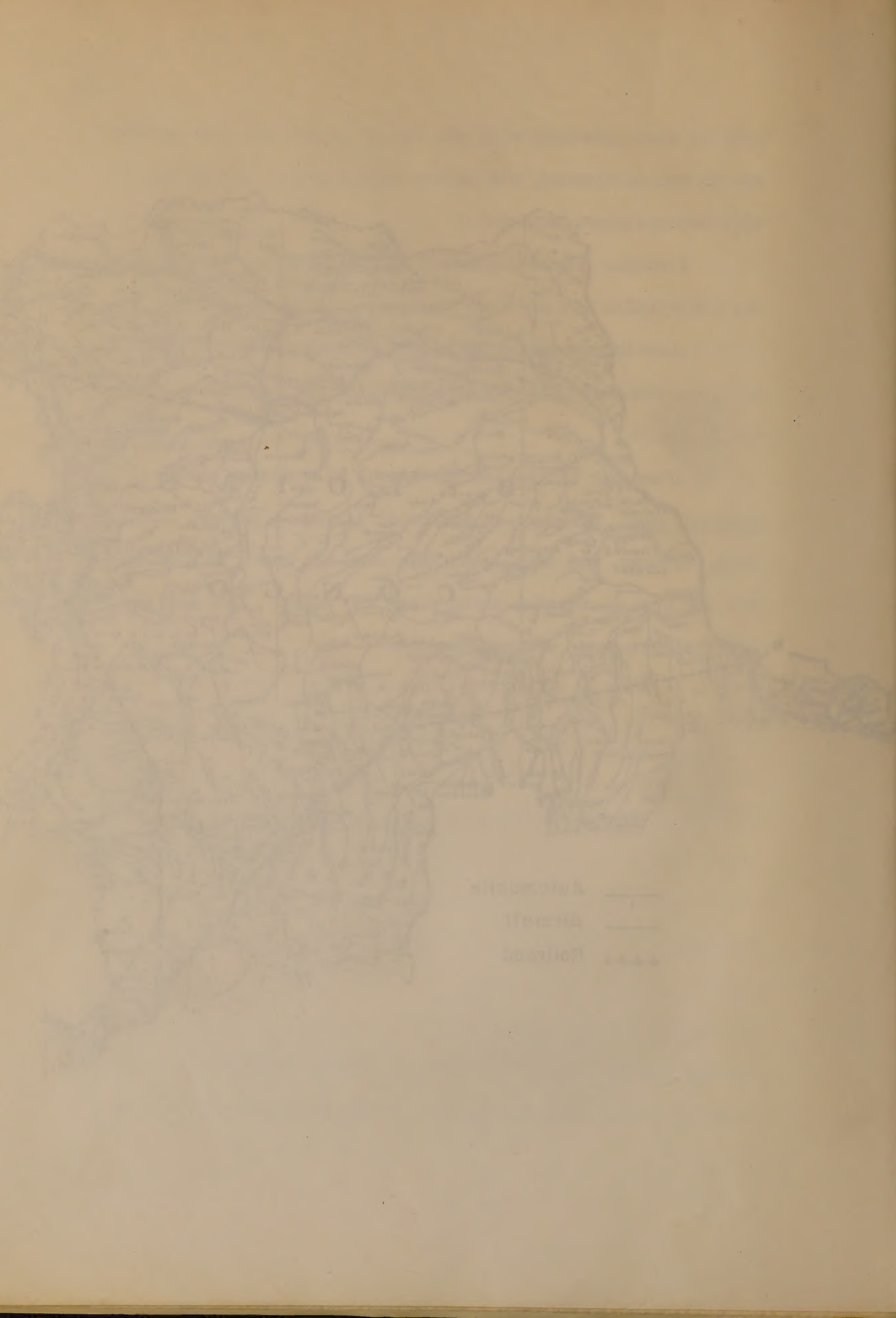
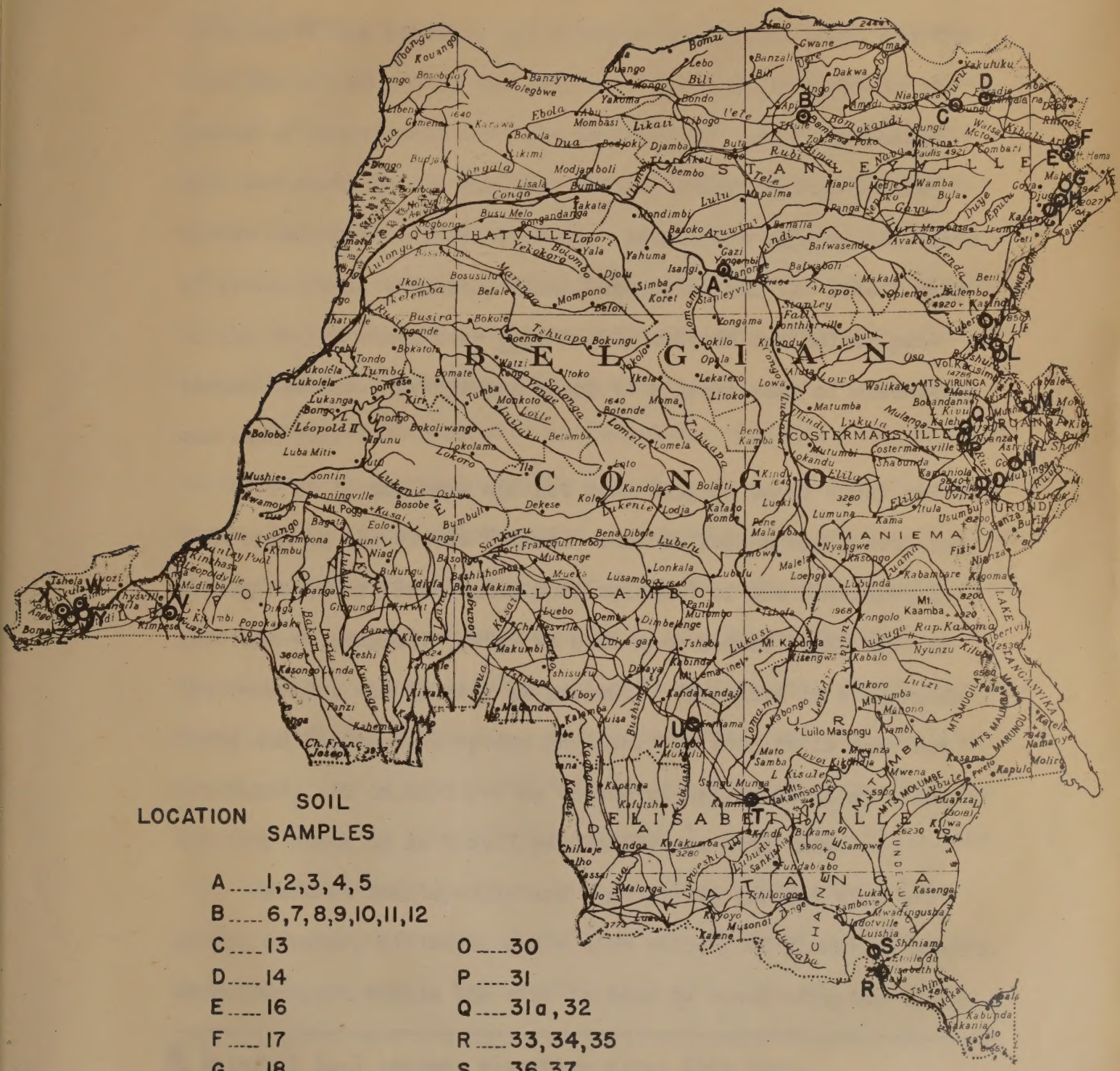
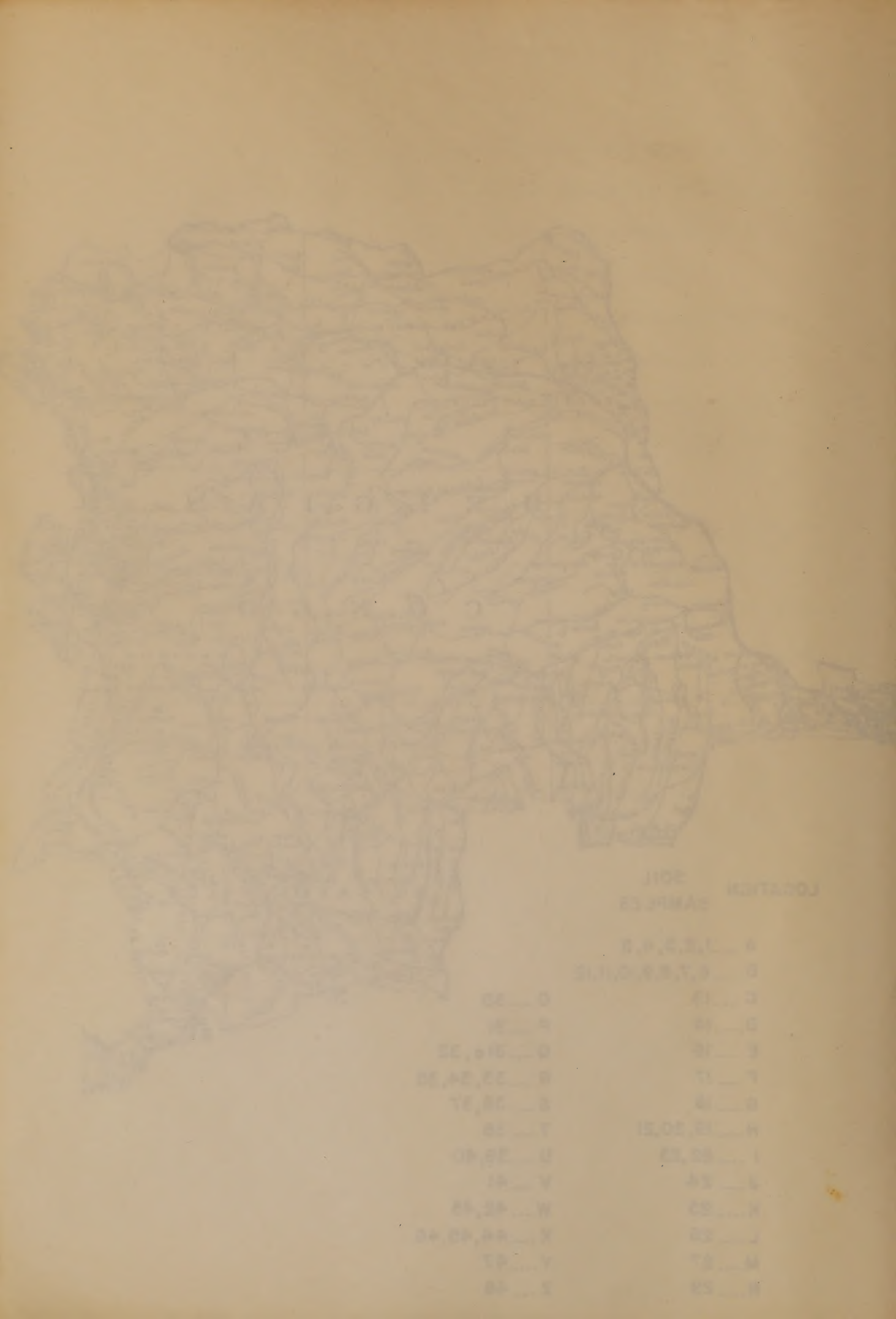
BELGIAN
CONGO
Automobile
Aircraft
Railroad





LOCATION	SOIL SAMPLES		
A	1,2,3,4,5		
B	6,7,8,9,10,11,12		
C	13	O	30
D	14	P	31
E	16	Q	31a, 32
F	17	R	33, 34, 35
G	18	S	36, 37
H	19,20,21	T	38
I	22,23	U	39, 40
J	24	V	41
K	25	W	42, 43
L	26	X	44, 45, 46
M	27	Y	47
N	29	Z	48



June 3: Stanleyville to Yangambi [a]

I am up at 6:20 with the crowing of the roosters, the gabbling of the turkeys, the cries of the guinea hens, and the bleating of the goats; and then in a few minutes there is the murmur of native talk over the whole city. It is reasonably cool now early in the morning. After breakfast I go to the native market -- a riot of color. People are selling all sorts of foods, fuel, trinkets, cloth, utensils, and the like. Many of the native women wear very highly colored and boldly patterned dresses. Everywhere there is a great deal of discussion and much fun.

I go to the bank and get some Belgian Congo money and mail film back to the United States. Then M. Jurion and I meet the Acting Governor (Provincial Commissioner) of the Stanleyville province -- Bougnet. Later we call upon Madame Bock, wife of the Governor, who is away at present. They live in a charming house and Madame Bock speaks English. By noon it is very hot and humid. It is hard for me to see clearly without my glasses but they steam up so that I can hardly see with them.

Here at Stanleyville are many pretty gardens with oil palms, bananas, hibiscus, and a wide variety of flowering plants. Most transport within the city is done by women carrying things

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[a] Rainfall 64.1 inches; elevation about 1350 feet.

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in baskets, trays, and bundles on their heads. Very little is carried by men. It is common to see women with a large (unborn) child in front, a bigger one fastened to the dress on the back, and a huge bundle of wood, fruit, fish, or what not on the head. Many of the women carry simply enormous baskets on their back held by a band around the forehead. Often their husband accompanies them carrying perhaps a cane, or nothing at all. (But of course the woman would be humiliated if he had to carry a bundle!)

One notices at once that there has been extremely little mixing between the whites and the blacks.

We leave Stanleyville at 1:20 p.m. The car, a new Mercury, is driven by M. Jurion's native driver -- Abua. Along with M. Jurion and me is the resident physician at Yangambi. We need to go along quite rapidly since the roads are not good, and it is important to get through the forest before dark. As we leave, the road is on an undulating terrace of brown fine sandy loam with strong reddish-brown in the higher places. In the deep road cuts the reddish-brown soil stands vertically like loess. (But of course this is not loess. It is probably old alluvium.) On either side of the road the vegetation is dense, even on the margins of oil palm plantings. We pass through small native villages near the city. The houses are small, rectangular, and made from mud bricks or mud plastered over a lattice of small poles and sticks. Part of them are white-washed. The roofs are thatched with palm leaves.

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Along the road I see some trees planted for reforestation where the savanna has come in following overcropping. We meet a great many natives carrying all kinds of tools and all sorts of things tied up in bundles. We see people washing their clothing and bathing in the streams. Near the villages there are always goats and chickens.

We pass through many spots of recent alluvium in the lower places. These spots may make up one-quarter to one-third (?) of the area. We pass a Hevea rubber plantation with trees about 3 to 6 inches d.b.h. After a few kilometers there is more red soil -- an orange-red fine sandy loam with a great many large termite mounds.

We cross the Tshopo River on a native ferry boat. This one was made by fastening a platform across 8 native canoes, which are made by hollowing out large logs. These are propelled by seven native paddlers (and a boss). A cable had been stretched across the stream to which the raft is fastened by another cable so that it may not float away if neglected. It is very hot indeed on the river. Along here one sees all kinds of food crops like cassava, bananas, oil palm, rice, and maize grown together in what looks like wild and utter confusion to a person from the temperate regions.

For cultivation of the soil, the trees of the forest are cut. Stumps and most non-commercial logs are left on the ground

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K-1362 June 3, 1947
Belgian Congo. Ferry at Tshopo River

K-1363 June 3, 1947
Belgian Congo. View from ferry up the
Linda River.

K-1362 June 3, 1947
Belgian Congo. Ferry at Tshopo River

K-1363 June 3, 1947
Belgian Congo. View from ferry up the Lindu River.

to rot and the crops planted in the mixture. A few trees are left for shade and regeneration. It takes a little time for the newcomer to distinguish between jungle and garden. M. Jurion says that these sandy soils should not be cropped for more than two years before returning to forest; otherwise the savanna may come in. In most places the forest is made up of many species, but in a few places one sees nearly pure stands of great macrolobium trees. The timber is very heavy but not generally useful. Around some of the native huts cannas, like those at home, are planted as ornamentals.

At about 2:40 p.m. we cross the Lindi River on a ferry like the previous one. We are still on an undulating plain. Here I see many umbrella trees which are excellent for shade and one of the very best plants in the tropics to improve the soil. A good stand of umbrella trees clearly indicates that the soil is again ready for cultivation. In the villages along the way there is much "taking of the ease" by the men in the native huts while the women are going about with their enormous loads of wood, bananas, and other things. Here the old women wear only a simple short skirt, but most of the younger ones wear some sort of complete dress.

Beyond Bengamisa there is a little more relief with gently rolling reddish-brown soil. There is quite a bit of cultivation, both food crops and oil palms. As at Stanleyville there are a

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large number of huge termite mounds. Near the village of Bengamisa there is an oil palm nursery for the natives, with the seeds furnished at a very low price by the Yangambi Station. There are said to be about 1,000 hectares of oil palm in this community besides some war-time planted Hevea.

About 10 kilometers beyond Bengamisa we enter a great forest reserve under the control of INÉAC. The soil is a gently rolling, reddish-brown, lateritic fine sandy loam. Along the roadway we see very little wet land since the highway is located on the boundary between two river basins with the Aruwimi to the north and the Congo to the south. For 170 kilometers the road is without a bridge. But within the forest there are a few native communities. About 25 kilometers west of Bengamisa the soil is a reddish-orange brown from deep red sandstone. It is mellow and has only a few small concretions. It isn't nearly as red as the mother rock. The road here goes through the heavy tropical rain forest. The large trees are macrolobium but there are many other species as well as shrubs and vines. Often these vines cross the road high above us. In the jungle I see three baboons. They don't seem to be very wild. But we must hurry on because it wouldn't do to be caught in this forest road in the dark. The trees are enormous and the vegetation is dense and everywhere a deep green. In a few minutes it rains, easily, straight down. Part of the time we have rain and hot sun together.

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About 10 kilometers beyond Bengamisa we enter a great forest reserve under the control of INEAC. The soil is a gently rolling, reddish-brown, lateritic fine sandy loam. Along the roadway we see very little wet land since the highway is located on the boundary between two river basins with the Aruwimi to the north and the Congo to the south. For 170 kilometers the road is without a bridge. But within the forest there are a few native communities. About 25 kilometers west of Bengamisa the soil is a reddish-orange brown from deep red sandstone. It is mellow and has only a few small concretions. It isn't nearly as red as the mother rock. The road here goes through the heavy tropical rain forest. The large trees are macrolobium but there are many other species as well as shrubs and vines. Often these vines cross the road high above us. In the jungle I see three baboons. They don't seem to be very wild. But we must hurry on because it wouldn't do to be caught in this forest road in the dark. The trees are enormous and the vegetation is dense and everywhere a deep green. In a few minutes it rains, easily, straight down. Part of the time we have rain and hot sun together.

The trees are simply gorgeous, very tall and two to four feet d.b.h. We go for miles and miles through this dense forest with only an occasional native village and its surrounding small fields.

One can always smell these villages in advance from the odor of burning damp wood. Each time we pass one the natives shout, among other things, "Bahta" (= "Good Day").

Just before six o'clock we pass Weko and then turn south on an INÉAC road through large plantings of food crops and industrial crops. It is said that some of the villages in this area practice communal farming in which they work together, but each family has its own individual produce. Many of the villages along this road have good rotations with rejuvenating forest. We drive through miles and miles of station grounds with large experimental plantings of rubber, oil palm, coffee, fiber crops, and food crops.

At 6:30 we reach M. Jurion's home on a beautiful site overlooking the Congo River — here more than two miles wide. This view is gorgeous beyond dreams.

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and Mr. Becquet, Assistant to Director General Jurion. There is much talk of Dutch colonial policy at dinner. Mr. Schuitenmaker represents the common type of arrogant Dutch plantation manager.

From what I have seen today and learned already, INÉAC is infinitely larger and more extensive than I had supposed. I go to bed at about 10:30. I hear the tom-toms of the local "telephone system". These drums are made by hollowing out short logs through a narrow slit. And of course I wonder what they are saying -- probably something about the new guest at Yangambi. But then I remember that the natives in this area were last known to have eaten a white man some 30 years ago. It is very hot and sticky, especially under a mosquito bar.

YANGAMBI

Hevea

Cacaoyers

Palmiers

Cult. vivrières

Caféiers

Divers

Limite rés. Floristique

échelle 1/50.000.

Vers Ngazi - Stan

Cult. vivrières

CAMP P.V.

Km 18

sample ② 1.1 1.2 1.3 1.4 ① 1.5

N

Lubilaie

Réserve Floristique

Mabuku

Bukoro

Bubulu

Bulo CAMP

CACAOYERS

CAFEIERS

Lubero

Kaluku

Kiondo

Ndaki

HEVEA

PALMIERS

Réserve Floristique

Laboratoire

Vestiaires

Jachères

Yungu

Beetle

Hôpital

CAMP

Quarters

MISSION

PALMIERS

I.6, 1.5, 1.4.6

Réserve Floristique

Jatropha

Jatropha

CAMP

PL

YANGAMBI

Jimbagos

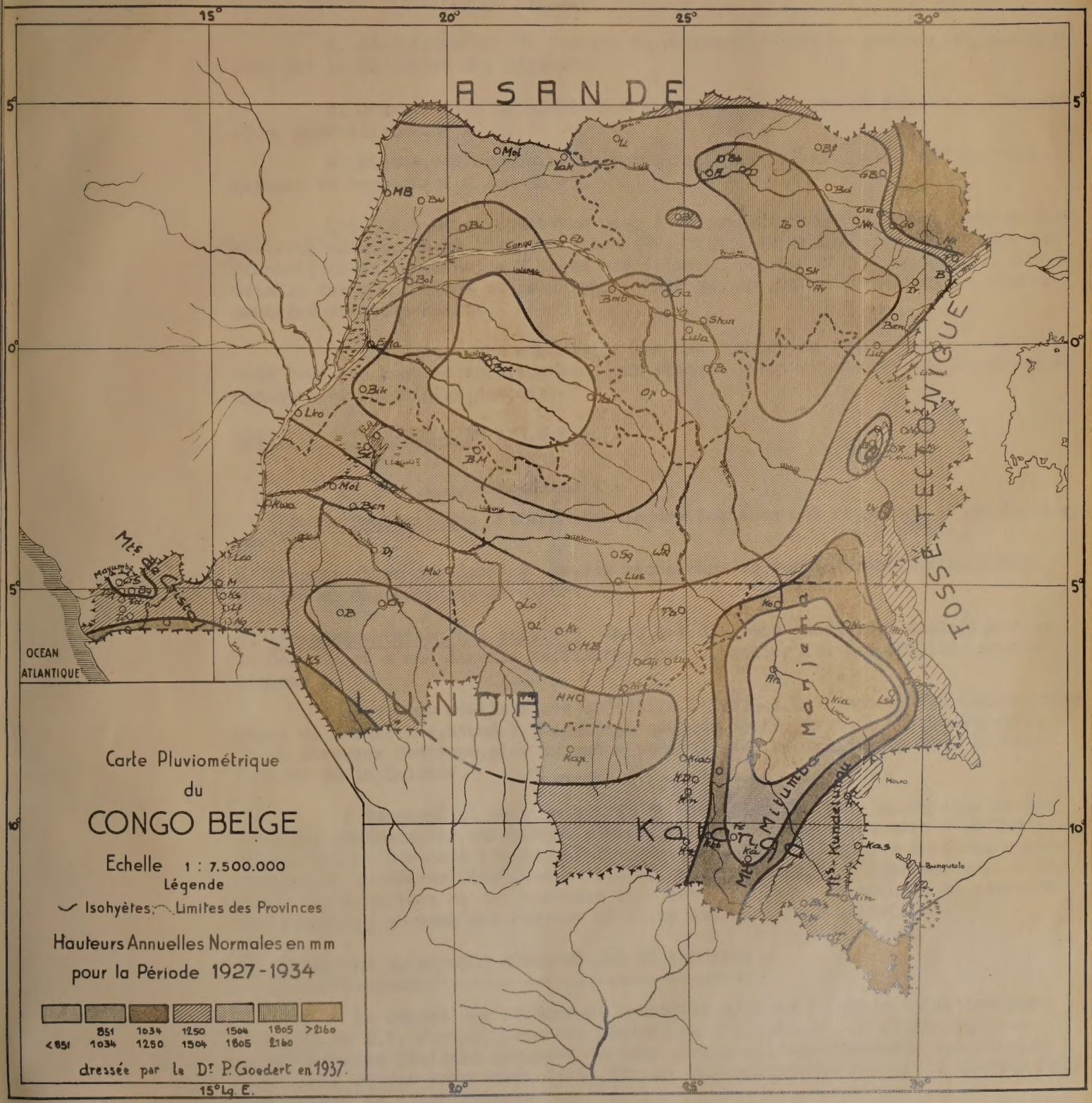
Jambuwe

Jambuwe

Soil lab.

D.C's home

FL. CONGO


15°
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ASANDE
TOSSELENGUE
OCEAN ATLANTIQUE
LUNDA
Mts. de Cristal
Mayumbe
Mts. Kundelungu
Mts. Kumbirendai
Mts. Mitumba
Mts. Mitwaba
Mts. Mwinilunga
Mts. Kibara
Mts. Marungu
Mts. Mufumbiro
Mts. Ruwenzori
Mts. Kundu
Mts. Kivu
Mts. Kabobo
Mts. Kamanyola
Mts. Kundelungu
Mts. Kumbirendai
Mts. Mitum

ORGANISATION ET ACTIVITE DE L'I.N.E.A.C. EN AFRIQUE.

Aux termes de l'A.R. constitutif du 22 décembre 1933, l'I.N.E.A.C., créé pour promouvoir le développement scientifique de l'agriculture au Congo belge, exerce les attributions suivantes:

1. Administration de Station de recherches dont la gestion lui est confiée par le Ministère des Colonies.

2. Organisation de missions d'études agronomiques et formation d'experts et de spécialistes.

3. Etudes, recherches, expérimentation, et, en général, tous travaux quelconques se rapportant à son objet.

L'I.N.E.A.C. ne constitue pas, à proprement parler, une institution nouvelle. Il résulte de la transformation d'un organisme préexistant : la "Régie des Plantations au Congo Belge ", plus spécialement chargée de l'exploitation industrielle des plantations de la Colonie, ainsi que la gestion des Stations expérimentales du Gouvernement.

L'I.N.E.A.C. est administré par une Commission et un Comité de Direction dont les membres appartiennent aux grandes Institutions scientifiques, agronomiques et coloniales du pays.

ACTIVITE SCIENTIFIQUE DE L'I.N.E.A.C.

L'I.N.E.A.C. s'applique à :

a) l'étude systématique et approfondie des facteurs qui régissent la production agricole;

b) l'application des données de ses recherches en vue de l'amélioration des plantes et des techniques culturales;

c) l'expérimentation des cultures dans les diverses conditions écologiques de la Colonie, et à une échelle suffisante pour apprécier les possibilités économiques.

En vue de réaliser ces objectifs, l'I.N.E.A.C. dispose d'un Centre principal de recherches, situé à Yangambi, à quelque 80 Km. en aval de Stanleyville et de diverses Stations, plus ou moins spécialisées, réparties sur tout le territoire de la Colonie.

A Yangambi, où sont installés la Direction Générale en Afrique et les Services généraux, les chercheurs s'appliquent en commun à résoudre tous les problèmes qui se posent à l'agriculture congolaise. En principe, les Stations expérimentales ou autres établissements, s'efforcent de vérifier localement le bien-fondé des doctrines et des méthodes établies à Yangambi et tâchent de résoudre des problèmes propres aux régions où elles exercent leur activité.

I. CENTRE DES RECHERCHES AGRONOMIQUES DE YANGAMBI.-

Le Centre des recherches agronomiques, sous l'habile direction personnelle de M.F. Jurion, Directeur Général de l'I.N.E.A.C. en Afrique, comprend diverses Division groupées en deux Sections, l'une consacrée aux recherches agronomiques proprement dites, l'autre aux recherches ressortissant aux Sciences de base de l'Agriculture.

A. Section des recherches scientifiques.

L'étude systématique des facteurs de la production incombe à la Section des recherches scientifiques qui groupe les diverses Divisions : Botanique, Physiologique, Phytopathologie, Forestière, Climatologie, Agrologie, Technologie, Génétique et Hydrobiologie.

I. Division de Botanique.

La Division de Botanique est chargée de l'étude de la flore indigène et des recherches de biologie végétale en relation avec l'agriculture.Elle comprend un Jardin botanique et un Herbarium à Yangambi,ainsi qu'un Jardins d'essais et d'introduction à Eala (Coquilhatville).Outre les recherches botaniques conduites à Yangambi et à Eala,des études agrostologiques et des essais d'amélioration des pâturages sont poursuivis dans l'Est de la Colonie.De plus,des prospections pédo-phytogéographiques sont en cours d'exécution.

Jardin botanique.

Le Jardin botanique de Yangambi est constitué par une Réserve de flore et des Collections végétales.

Les réserves occupent quelque 230.000 Ha.Elles comprennent la réserve forestière de l'Entre-Congo-Lindi-Aruwini,un chapelet d'îles sises dans le bief de 20 km. entre Yalutsha,en amont,et Yalufi,en aval,et représentant toutes les étapes colonisatrices de ce milieu spécial,ainsi que la réserve floristique intégrale de l'Isalowe,dépendance immédiate du Jardin Botanique.

Celle-ci occupe la vallée de l'Isalowe,où les arbres,arbustes et lianes sont étiquetés au fur et à mesure de leur identification.Les végétaux se développent selon l'habitus propre à leur milieu naturel et sont maintenus dans des conditions d'environnement auxquelles ils sont strictement adaptés.

Le Jardin botanique abrite d'importantes collections de plantes groupées selon leur habitat naturel.Il comporte également des parcelles de collections écologiques où sont groupés, par ensembles naturels,les végétaux caractéristiques d'un milieu donné et des collections de plantes des savanes congolaises.

Herbarium.

Régulièrement enrichi,l'Herbarium contient actuellement quelque 35.000 exsiccata dont la conservation est régulièrement surveillée. C'est grâce à cet herbier que peuvent s'effectuer les nombreuses déterminations de plantes nécessaires aux recherches des Divisions agronomiques.L'Herbarium centralise également l'ensemble des récoltes botaniques effectuées au Congo Belge.

La Division de Botanique se charge encore de l'envoi de matériel d'érude aux Institutions scientifiques de la Métropole.

2. Division de Physiologie végétale.

Récemment créée,cette Division est chargée de l'étude des fonctions physiologiques des plantes cultivées dans le cadre du programme général du Centre des Recherches de Yangambi. Actuellement,son activité est surtout absorbée par l'organisation de la Division et l'équipement du Laboratoire. Des recherches préliminaires sont en cours sur la transpiration et l'équilibre hydrique du palmier Elaeis et des palmeraies cultivées.Des résultats importants au point de vue pratique ont déjà été obtenus.

Des expérience sont également en cours sur la nutrition minérale et le besoin en engrais ou en oligo-éléments du palmier à huile.

3. Division Forestière.

L'objectif primordial de la Division Forestière réside dans l'établissement d'une doctrine forestière au Congo belge.La Division comprend le Centre de Yangambi,la Réserve forestière de la Luki (Mayumbe) et les Postes forestiers de la Vuazi (Bas-Congo) et du Katanga.

Le programme assigné au Centre de Yangambi implique la surveillance de la réserve forestière,la poursuite des observations sur la biologie des essences forestières et le dépouillement des données acquises,l'exécution des plantations courantes et l'observation des essences de l'Arboretum et des parcelles d'observation,ainsi que la collaboration au programme général du Centre des Recherches à Yangambi.

Des essais,fort importants,sont en cours sur les méthodes d'enrichissement et d'exploitation rationnelle et harmonieuse de la forêt équatoriale.

L'Arboretum de Yangambi,régulièrement enrichi,éprouve les essences forestières susceptibles d'un intérêt économique.Le comportement de ces essences sous le couvert de la strate arborescente,après abatage du sous-bois,est étudié en parcelles d'observation.La confrontation des résultats en Arboretum et en parcelles d'observation permet d'établir le tempérament des essences.

D'autres parcelles,dites d'enrichissement,ont pour but de rechercher le meilleur mode d'application à la pratique forestière courante des données acquises par les études préliminaires sur les questions fort importantes du tempérament des espèces dans le jeune âge,des modes de propagation et de plantation les plus adéquats et les plus satisfaisants.

Ces parcelles d'enrichissement forestier en essences précieuses sont organisées sur un plan purement économique et pratique. Elles contribueront,dans une large mesure,au progrès de la sylviculture coloniale.

Diverses études sont poursuivies régulièrement depuis de nombreuses années :contrôle périodique et individuel des phénomènes végétatifs et biologiques de 600 arbres numérotés,étude morphologique des plantules forestières,. observations sur la germination,etc...

4. Division d'Agrologie.

L'étude du sol et de son comportement sous l'action des différentes techniques culturales incombe à la Division d'Agrologie.
En plus des prospections et des travaux de laboratoire,la Division contribue à la réalisation du programme général du Centre des recherches de Yangambi par des études de pédogenèse,de minéralogie,de physico-chimie et de microbiologie du sol.

Laboratoire de pédologie de Yangambi.

L'équipement du Laboratoire de pédologie est activement poussé. Son activité est plus particulièrement orientée vers la mise au point des méthodes d'analyse,l'étude de l'échantillonnage des terres et l'exécution des analyses courantes. Le laboratoire de recherches étudie la nature intime des phénomènes pédologiques d'ordre physico-chimique et,notamment,le rôle de l'humus dans les terres tropicales.

Recherches.

En plus de la collaboration aux travaux du Centre des Recherches de Yangambi,la Division participe aux expériences de fumure et de maintien de la fertilité du sol conduites dans les Divisions culturales.

En collaboration avec la Division de botanique,une première équipe a été créée cette année en vue de dresser progressivement la carte pédologique et phytogéographique de la Colonie.

5. Division de Climatologie.

De création récente,cette Division est chargé de l'étude des conditions climatériques de la Colonie et du contrôle des Postes climatologiques de l'I.N.E.A.C.

Un Centre d'observation éco-climatologique est en voie d'équipement à Yangambi.

La Division dépouille les données actuellement recueillies,étudie les époques favorables à la plantation des cultures vivrières et contribue au programme général du Centre des Recherches de Yangambi par l'installation de Postes de microclimatologie destinés à suivre de près l'évolution du milieu dans les plantations.

6. Division de Technologie agricole.

L'étude des modes de préparation des produits incombe à la Division de Technologie agricole. Outre les analyses courantes effectuées en laboratoire, la Division est plus spécialement chargée de l'étude technologique du palmier Elaeis. Elle collabore également à la réalisation du programme général du Centre des Recherches de Yangambi.

Avant-guerre, les travaux de la Division ont permis d'élucider divers problèmes technologiques relatifs au palmier à huile, aux caféiers arabica et robusta, au cacaoyer, aux plantes à huiles essentielles et chaulmoogriques, etc..

7. Division de Phytopathologie et d'Entomologie.

Cette Division étudie les maladies et ennemis des plantes cultivées et assume le contrôle phytosanitaire de la Colonie. Elle dispose d'un Laboratoire central à Yangambi et de Laboratoires régionaux à Bambesa, Gandajika, Mulungu et Keyberg.

Le Laboratoire central, qui contribue avec les autres Divisions aux travaux généraux du Centre des Recherches de Yangambi, s'occupe plus spécialement de l'étude phytopathologique du palmier à huile et des pourridiés de l'hévéa. Il organise, le cas échéant, des missions de prospection et de contrôle phytosanitaires.

Le Laboratoire de phytopathologie de Bambesa est chargé de la surveillance phytosanitaire de la culture cotonnière en Région Nord. Il étudie plus spécialement les Helopeltis nuisibles au cotonnier et collabore aux recherches de la sélection en vue de la résistance aux maladies.

Le Laboratoire de phytopathologie de Gandajika contrôle la situation phytosanitaire de la culture cotonnière dans la Région Sud et étudie certaines affections des plantes en culture.

Le Laboratoire régional de Mulungu (Kivu) groupe les Sections d'Entomologie et de Mycologie. En plus de la surveillance phytosanitaire locale, il est actuellement chargé de l'étude des maladies de la patate douce et de la pomme de terre.

Un Laboratoire de Phytopathologie est également annexé à la Station de Keyberg.

8. Division de Génétique.

L'étude des facteurs héréditaires des plantes cultivées est dévolue à la Division de Génétique. Grâce à son étroite participation aux recherches de la Division du palmier à huile, la Division de Génétique a pu éclairer bien des points de l'hérédité de l'Elaeis qui se sont traduits, en fin de compte par des progès notables de la sélection.

9. Division d'Hydrobiologie.

Cette Division, de création récente, est appelée à jeter les bases de la pisciculture rationnelle dans les régions basses de la cuvette équatoriale du Congo.

B. Section des recherches agronomiques.

La Section des recherches agronomiques a dans ses attributions l'amélioration des plantes cultivées et l'expérimentation des techniques culturales.

L'Elaeis, l'hévéa, le caféier, le cacaoyer et les plantes vivrières sont étudiés par des Divisions agronomiques spécialisées.

I. Division du Palmier à l'Huile.

L'amélioration et l'expérimentation culturale du palmier à huile sont conduites sur près de mille hectares de palmeraies.
Les travaux afférents à la sélection comprennent,en ordre principal,le contrôle de la productivité,l'observation des descendances.,la pratique des fécondations artificielles,en vue de la sélection et de la production de graines améliorées la prospection systématique des palmeraies naturelles ou cultivées pour la recherche de types exceptionnels,et l'organisation d'essais,comparatifs locaux.

Toute ces opérations sont réalisées sur uen très grande échelle.Quelque 50.000 palmiers sont régulièrement contrôlés au point de vue de la productivité. L'analyse physique d'environ 25.000 régimes par exercice poursuit un triple but: La recherche d'arbre d'élite,la confrontation des lignées et l'étude biométrique et héréditaire des caractéristiques organographiques et physiques des infrutescences.

Des collections groupent un nombre considérable de types d'Elaeis.

Parmi les travaux relatifs à l'expérimentation culturale,il convient de souligner l'importance des études sur la protection et la régénération des terres.

De multiples recherches,telles l'analyse des composantes de la productivité,l'étude de la stérilité héréditaire chez certains palmiers et l'impureté génétique du caractère "tenera" ,transposées dans le domaine pratique,ont déterminé de fructueuses améliorations du matériel de plantation.

La participation de la Division au programme général des recherches du Centre de Yangambi est particulièrement importante.

La Division se charge encore de la diffusion,auprès des palnteurs européens et indigènes,d'importantes quantités de graines sélectionnées.Près de 3 millions de graines furent distribuées au cours du seul exercice I945.

2. Division de l'Hévéa.

Près de 500 Ha.sont couverts par les plantations expérimentales de la Division de l'Hévéa.

La sélection s'effectue par les voies génératives et végétatives.

Les principaux essais culturaux concernent les méthodes de saignée,l'amélioration de la technique de la greffe,la formation de la couronne et le dispositif de plantation. La protection et l'amélioration du sol constituent les préoccupations majeures.

La Division est encore chargée de l'étude de Derris, plante insecticide.

D'autres études sont poursuivies dans le cadre du programme général du Centre des recherches de Yangambi.

Enfin, la Division contribue directement à l'amélioration des plantations par la fourniture d'importantes quantités de bois de greffe et de graines sélectionnées.

3. Division du Caféier et du Cacaoyer.

Caféier.

Les travaux de sélection et d'expérimentation culturale concernent le caféier robusta.

Dans ses grandes lignes,les opérations de sélections comprennent, au Stade actuel,le contrôle des descendances des arbres-mères et la multuplication des meilleurs clones.Environ 250 arbres-mères,maintenus à la suite d'un contrôle sévère,sont étudiés dans leurs descendances génératives,légitimes ou illégitimes et végétatives.

L'observation des caféiers spontanés,d'une grande importance pour l'amélioration, est poursuivie.

Du point de vue cultural,les efforts sont principalement orientés vers le maintien de la fertilité du sol,la longévité et la taille des caféiers,ainsi que vers l'introduction et l'observation des arbres d'ombrage.

Cacaoyer.

Les cacaoyers sous contrôle sont constitués, en majeure partie, par des arbres du type "Forastero" et du matériel hybride "Criollo-Forastero".

La Subdivision du Cacaoyer contrôle les descendances généalogiques des arbres-mères maintenus en observation,et organise des essais comparatifs locaux.

Des collections et jardins d'introduction groupent un important matériel d'origines très diverses ;ils constituent pour le sélectionneur un réservoir précieux de matériel et de caractères génétiques.

L'expérimentation cultural concerne plus spécialement la recherche et l'observation des arbres d'ombrage,ainsi que l'organisation d'essais d'aménagement de cacaoyères.

Comme les autres Divisions,la Division du Caféier et du Cacaoyer participe aux recherches coordonnées du Centre des recherches de Yangambi. Elle fournit également aux planteurs,européens et indigènes,du matériel sélectionné de multiplication.

4. Division des Plantes vivrières.

L'I.N.E.A.C. a toujours attaché une importance particulière aux travaux de la Division des Plantes vivrières.Celle-ci s'efforce de rechercher, d'isoler ou de créer les variétés les plus rustiques et les plus productives et de tenter l'acclimatation de vivres végétaux susceptibles d'enrichir la ration alimentaire indigène.Elle recherche les méthodes culturales susceptibles d'assurer le meilleur rendement tout en protégeant la fertilité native des terres. L'activité de la Division s'étend sur une bonne part de la Colonie.Elle contrôle en outre,les nombreux essais vivriers inscrits au programme de la plupart de nos Stations.

La sélection des plantes vivrières n'est pas seulement cantonnée au seul objectif quantitatif.Elle est encore orientée vers l'amélioration qualitative - nutritive et énergétique - des produits alimentaires.

Citons,parmi les principales plantes vivrières étudiées à Yangambi : arachide,bananier,Coïx , Dioscorea,maïs,manioc,riz,patate douce, haricot,soja,etc...

D'importantes recherches sont poursuivies sur la rotation et la diversification des cultures en milieu indigène.La culture en couloir,plus rationnelle au point de vue de la protection du sol,a été mise au point par la Division. Dans le cadre général du programme du Centre des Recherches de Yangambi,l'étude de la régénération et de la jachère incombe plus particulièrement à la Division des Plantes vivrières.Une première réalisation de ces travaux est concrétisée par la constitution en coopérative du groupement indigène Turumbu.

Des études préliminaires ont été entreprises sur les possibilités de mécaniser et de faciliter les opérations culturales indigènes.

Relevons parmi les autres points à l'étude :une étude préliminaire des plantes légumières indigènes,des recherches sur les plantes à fibres susceptibles d'intervenir dans les rotations indigènes, etc...

II. SERVICE DES PLANTATIONS EXPERIMENTALES.-

Le service des Plantations expérimentales groupe plusieurs

plusieurs plantations établies à échelle industrielle et qui constituent pour les diverses Divisions spécialisées du Centre des Recherches de Yangambi un vaste terrain de recherches et d'expérimentation.

I. Plantation expérimentale de Yangambi.

Elle cultive l'hévéa , la palmier Elaeis , le cacaoyer et le caféier robusta, ces derniers en culture intercalaire.

Les champs servent de cadre aux recherches à grande échelle.Dans ses grands traits, le programme en cours prévoit le rajeunissement de divers blocs d'hévéa,l'introduction de plantes de couverture érigées autochtones dans les plantations dénudées, l'observation des productions individuelles des familles illégitimes d'hévéa,ainsi que l'étude de la mécanisation de l'entretien des rajeunissements "hévéa" et des plameraies.

A la ferme,l'amélioration des pâturages est conduite en collaboration avec la Division de Botanique.

2. Plantation expérimentale de Gazi.

A Gazi, la Plantation comprend des cultures d'hévéa ,cacaoyers et palmiers.Le programme suit l'orientation générale de celui de la plantation de Yangambi.

Un essai de cultures mixtes de cacaoyers et de palmiers,en collaboration avec les indigènes,est poursuivi dans le groupement de Weko.

3. Plantation expérimentale de Lula.

Jadis orientée exclusivement vers la production caféière,la Plantation de Lula accorde,actuellement,une attention croissante à l'hévéaculture.

Le comportement et l'économie de la culture miste hévéa-caféier sont étudiés sous trois dispositifs de plantation : interplantation des hévéas en quinconce,en allées ou en lignes.

Divers travaux de sélection et d'expérimentation culturale sont effectués pour le compte des Divisions spécialisées.

4. Plantation expérimentale de Barumbu.

Constituée par la reprise d'anciennes emblavures en lianes caoutchoutières, caféiers,Funtumia, hévéas, cacaoyers et palmiers à huile,la Plantation de Barumbu offre des conditions favorables à l'étude du rajeunissement des plantations,de la régénération des sols et des produits. Elle couvre,aujourd'hui plus d'un millier d'hectares.

Les essais de régénération du sol accaparent la majeure partie de l'activité:ils sont poursuivis avec méthode et sur une vaste échelle. La Plantation participe,en outre,à diverses recherches de sélection et d'expérimentation culturale.

A l'exemple des autres Plantations du rayon de Yangambi,la Plantation de Barumbu est rationnellement équipée pour l'usinage de ses produits.

5. Centres d'hévéaculture.

Deux plantations expérimentales,l'une à Bongobo,dans le District de Lisala,l'autre à Mukumari,à la limite des Territoires de Lomela et de Lodja, ont été créées dans le but de promouvoir l'hévéaculture au Congo belge. Elles sont plus spécialement destinées à étudier et à démonter les possibilités techniques et économiques de l'hévéa en diverses régions de la Colonie.

III. SECTEUR DES REGIONS EST.

Le Secteur Oriental groupe les Stations expérimentales des

régions montagneuses de l'Est de la Colonie:la Station expérimentale de Nioka (Ituri),la Station expérimentale de Mulungu-Tshibinda (Kivu) et la Station de Sériciculture et d'Apiculture du Mont-Hawa (Ituri). Les Stations gouvernementales du Ruanda-Urundi soumises à la gestion technique de l'I.N.E.A.C.

I. Station expérimentale de Nioka.

Située dans l'Ituri, à quelque I.800 mètres d'altitude,la Station de Nioka expérimente et améliore les cultures propres aux climats d'altitude : caféier arabica, quiquina,théier,pyrèthre,aleurites,plantes à parfun,cultures vivrières,etc...

En outre,un important département zootechnique et agrostologique ainsi qu'un Laboratoire de recherches vétérinaires,situé à Gabu,sont annexés à la Station.

Tant par la fourniture de bétail d'élevage et de matériel sélectionné de plantation,que par l'appoint technique,la Station contribue directement au développement de la colonisation européenne.Elle aide également l'agriculture indigène par l'établissement de fermes modèles,l'organisations de travaux anti-érosifs,la diffusion de matériel de multiplication et de semences forestières,etc.

2. Station expériemntale de Mulungu-Tshibinda.

Etablie à proximité de Costermansville, entre I.650 et 2.I00 mètres d'altitude,la Station du Kivu s'adonne plus intensivement à l'étude culturale du quinquina,du pyrèthre,du caféier,du théier,des aleurites et des cultures vivrières.Un Laboratoire de chimie et un Laboratoire de phytopathologie lui sont annexés.

Par suite de l'importance du quinquina et du pyrèthre dans l'économie de guerre,la Station a considérablement amplifié son activité.

La sélection du quinquina ledgeriana est conduite sur une très grande échelle : des milliers de candidats arbres-mères sont choisis, analysés multipliés et controlés. Plusieurs milliers d'hybridations accouplent,chaque année,les clones les plus prometteurs.Quelques arbres-mères ont accusé une teneur en sulfate de quinine voisine de 20 %.Diverses recherches connexes à la sélection du quinquina sont poursuivies : étude des périodes de croissance, essais de bouturage des feuilles et pousses terminales,duplicature des nombres chromosomiques par traitement des semences aux alcaloïdes,etc.

Des expériences culturales recherchent la durée des peuplements et déterminent l'influence des engrais, des écartements,du mode d'exploitation de la fixation des terres,etc...sur le rendement quantitatif et qualitatif des écorces.L'incidence des éclaircies et du mode de défrichement sur les attaques d'Helopeltis, déprédateur le plus grave,et sur l'apparition des maladies radiculaires,est observée en collaboration avec le Service phytopathologique.

La sélection du pyrèthre est également organisée d'une façon ample et méthodique.Des milliers de clones et lignées, à productivité et teneur en pyréthrines élevée,sont comparés et croisés .Certains clones accusent des teneurs des capitules supérieures à 2 % en principes actifs.De nombreuses recherches sont conduites parallèlement à la sélection :création de types polyloïdes par traitement des semences à la colchicine, étude biologique de la fécondation, déterminations entre la teneur en pyréthrines et les caractéres morphologiques des capitules,etc...
Divers essais culturaux visent à la régénération des plantations.
La variation de la teneur en pyréthrine est étudiée,en collaboration avec le Service chimique,au cours des différentes périodes de végétation et avec l'âge des plantations.

Récemment entreprise,l'étude de l'amélioration des aleurites producteurs d'huiles siccatives est orientée vers le double objectif quantitatif et qualitatif. Les recherches concernent plus particulièrement l'aleurite montana dont les possibilités culturales s'avèrent intéressantes au Kivu.

L'organisation de la sélection est étayée par des études relatives à la multiplication végétative et générative : mise au point du greffage,technique des autofécondations et croisements,etc.

L'effort considérable imposé par les circonstances au développement du quinquina et du pyrèthre s'est déployé aux dépens de l'amélioration du caféier arabica et du théier.

Détenant jadis la majeure partie de l'activité,la sélection et l'expérimentation du caféier arabica avaient acquis un haut degré de perfectionnement.

La sélection du caféier arabica et du théier est reprise actuellement sur la base des programmes initiaux.

Une aide substantielle fut prodiguée aux planteurs indigènes par l'amélioration de la patate douce,culture vivrière fondamentale des autochtones du Kivu.L'objectif de la sélection fut orienté vers la recherche de clones résistants aux viroses et de clones hâtifs à haute productivité.Quelque 3.000 types nouveaux marquèrent une très nette supériorité sur les variétés locales.

Actuellement,la Section des cultures vivrières a acquis un développement considérable:l'amélioration génétique et culturale des haricots et du manioc,autres cultures vivrières importantes,est poursuivie synchroniquement avec l'étude de la papate douce.Des essais comparatifs éprouvent, en divers milieux indigènes,la valeur des nouvelles sélections.

D'autres questions reçurent l'attention de la Station. Citons, entre autres,les problèmes du reboisement et de la régénération des sols,l'étude des plantes à huiles essentielles de haute altitude,l'acclimatation et l'expérimentation de nouvelles cultures susceptibles d'être incorporées dans un système polycultural d'agriculture,etc...

Un Laboratoire de Chimie,indispensable à l'analyse qualitative du matériel de sélection,fut créé et équipé au cours de la guerre.

Imposé par l'extension croissante de son activité,un Laboratoire des selections et d'analyses grainières,complété par des locaux de triage et d'emmagasinement,fut également édifié en période de guerre.

Par la fourniture d'importantes quantités de matériel sélectionné de multiplication,la formation de stagiaires,blancs et noirs,l'organisation de champ de démonstrations et la diffusion de conseils techniques,la Station de Mulungu a contribué dans une large mesure au développement de la colonisation européenne et de l'agriculture indigène.

3. Station de Sériciculture et d'Agiculture du Mont-Hawa (Ituri)

Par suite du contrôle des principaux centres producteurs de soie naturelle par les puissances de l'Axe ,l'activité de la Station de Sériciculture fut considérablement accrue.Sa gestion a été reprise,récemment , par l'I.N.E.A.C. qui orientera dorénavant son activité dans le seul domaine de la recherche sériciole en milieu indigène et de la culture du murier.

IV. SECTEUR DU BAS-CONGO

Le Secteur du Bas-Congo groupe trois Stations expérimentales :

1. Station expérimentale des plantes fruitières de Vuazi.

Essentiellement dévolue à l'amélioration génétique et culturale des productions fruitières,la Station de Vuazi est encore chargée de l'introduction et de l'acclimatation de diverses plantes,de travaux sylvicoles et de l'extension rationnelle d'un noyau d'élevage.

2. Station d'essais de Kondo.

Les culture du palmier à huile,du caféier robusta,de l'hévéa et du cacaoyer y sont étudiées dans les conditions locales du Mayumbe.

3. Station d'essais des plantes à fibres de Gimbi.

Consacrée spécialement à l'étude des plantes à fibres,la Station de Gimbi introduit encore diverses collections de plantes vivrières et autres,et entretient des essais de régénération forestière.

V. STATIONS DE SELECTION ET D'EXPERIMENTATION COTONNIERES.-

La sélection et l'expérimentation cotonnières sont poursuivies dans deux Stations principales : Bambesa,dans la région forestière du Nord de la Colonie,et Gandajika,dans la région des savanes du Sud. Des centres expérimentaux et de multiplication,actuellement réduits à deux, établis en zones écologiques différentes,sont annexés à ces Stations :Boketa ,dans l'Ubangi, et Lubarika,dans la plaine de la Ruzizi,au Kivu.

A. Région Nord.

I. Station expérimentale de Bambesa (Uele)

L'objectif primordial de la Station de Bambesa réside dans l'amélioration quantitative et technologique du coton.Les résultats pratiques de la sélection se concrétisent dans l'amélioration des familles Stoneville qui ont supplanté les anciennes sélections cotonnières.Des hybridations sont effectuées en vue d'améliorer le rendement à l'égrenage de la famille Stoneville 5. Grâce à l'irrigation de parcelles en inter-campagne, les opérations d'hybridation peuvent s'opérer sans perte de temps.Des échantillons de coton sont régulièrement prélevés en vue du contrôle technologique de la fibre et de son appréciation commerciale.

Au point de vue cultural, une étude,d'une importance primordiale et à échéance prolongée,a été entreprise dès 1939, sur les rotations et les jachères;elle vise à déterminer la longueur optimum du cycle cultural et du cycle des jachère, ainsi que la nature de ces dernières,en vue de la sauvegarde la plus efficace de la fertilité du sol.

Citons parmi les autres essais culturaux sous contrôle :la détermination de la place idéale du coton dans l'assolement et d'épreuve des avant- cultures favorables au coton,la technique de la protection du sol, l'action intrinsèque du paillis,etc... Un essai de conservation de la valeur germinative des graines de coton ,après séchage ou non, est conduit en magasin,en sile et en sacs.

En collaboration avec les Divisions spécialisées du Centre des recherches de Yangambi,la Station poursuit des essais variétaux et culturaux sur les cultures vivrières et quelques cultures industrielles d'intérêt régional, telles que l'hévéa,le caféier robusta, les aleurites.

La Station contribue encore activement à l'instauration d'un paysannat indigène fécond par le contrôle direct d'une centaine de fermettes attenant à la Station.De plus, elle apporte son concours au parcellement de la chefferie Asegala;un agronome est spécialement chargé de l'installation de six cents planteurs sur un axe d'une vingtaine de kilomètres,rejoignant Bambesa à Moswa.

Outre les travaux cotonniers poursuivis en Station,la production du coton-graines de toutes les usines de l'Uele et de l'Ubangi est contrôlée et analysée à l'issue de chaque campagne cotonnière; la pureté du type de chaque échantillon est déterminée après ensemencement en plain champ.

2. Centre Cotonnier de Boketa (Ubangi)

Le Centre de Boketa,dépendant de la Station principale de Bambesa, est principalement chargé de la multiplication des lignées sélectionnées destinées aux zones cotonnières de l'Ubangi.

B. Région Sud.

I. Station expérimentale de Gandajika (Lomani).

Outre la poursuite de l'amélioration génétique et culturale du coton,en Station et en divers milieux indigènes de la Région Sud de la Région Sud de la Colonie,la Station de Gandajika s'adonne activement à l'amélioration des plantes vivrières et au perfectionnement du paysannat indigène .

2.Centre Cotonnier de Lubarika (Kivu).

Le Centre est plus spécialement chargé de la sélection du cotonnier dans les conditions particulières de la plaine de la Ruzizi.

VI. SECTEUR DU KATANGA.-

Station du Keyberg (Elisabethville).

Récemment reprise au Comité Spécial du Katanga,la Station a pour rôle de promouvoir le développement de l'agriculture européenne et indigène au Katanga.

Pour répondre à cet objectif,divers groupes d'activité sont en voie de création ou d'organisation.

Les recherches relatives à l'élevage et à l'aménagement de pâturages,à l'arboriculture fruitière et à l'étude des forêts y revêtent une importance primordiale.

VII. STATION DU KWANGO.

Cette Station,en voie de réalisation,consacrera son activité à introduire et à améliorer des spéculations culturales indigènes.

VIII. STATIONS DU RUANDA-URUNDI.-

Les Stations du Ruanda-Urundi ,sous la gestion technique de l'I.N.E.A.C., comprennent la Station de Rubona (Ruanda) la Ferme de Nyamyaga (Ruanda) et la Station de Kisosi (Urundi).

Leur activité est, plus spécialement,orientée vers l'amélioration et le développement de la culture et de l'élevage indigènes.

REPARTITION ORGANIQUE DE L' I.N.E.A.C. EN AFRIQUE
AVEC INDICATION EVENTUELLE DES SUPERFICIES PLANTEES
ET DU PERSONNEL EUROPEEN ET INDIGENE.

I. DIRECTION GENERALE et SERVICES GENERAUX EN AFRIQUE :

(Secrétariat, Service médical, Comptabilité,
Atelier mécanique, Constructions et Station centrale).

(1250 travailleurs)

Directeur Général : M. Jurion,F.

Secrétariat : M. Rubbens,A.

Comptabilité :
Adjoints : MM. Govaerts,E
Van Hoef,M.

Service médical :
Chef : Dr. Barlovatz,A.

Atelier mécanique :
Chef : M. Bourgois,A.
Adjoints : MM. Brancos
Grietens,F
Nicaise,C
Pauwen,J
Pinelle,F
Plasman,R.

Constructions :
Chef : M. Tiberghien,M.
Adjoints : MM. Stas,L
Stradiot,H
Van Damme,J
Vulsteke,O.

Station Centrale :
Chef : M...
Adjoints : MM. Dejonge,H
Denis,R
Jeromsky,G.

II. CENTRE DES RECHERCHES AGRONOMIQUES DE YANGAMBI.

A. SECTION DES RECHERCHES SCIENTIFIQUES.

Chef : M. Gilbert,G.

1. Division de Botanique : (250 travailleurs)
Chef : M. Germain,R.
Assistants : MM. Léonard,J.
Mullenders,H.
Taton,A.
Adjoint : M. Kesler,W.

Jardin d'Essais d'Eala :

Conservateur : M. Poucet,J.
Adjoint : M. Van Helmont,M.

2. Division de Physiologie végétale :

(10 travailleurs)
Chef : M. Homes,M.
Assistant : M. Ringoet,A.

3. Division Forestière :

(250 travailleurs)
Chef : M. Gilbert,G.
Assistant : MM. Capon,E
Devred,R
Schmitz,A
Wagemans,J.

Réserve de la Luki (Mayumbe) :

Conservateur : M. Donis,C.
Assistant : M. Toussaint,L.

4. Division d'Agrologie :

(30 travailleurs)
Chef : M. Livens,P.
Assistants : MM. Croegaert,J
D'Hoore,J
Denisoff,I.
Focan,A
Fripiat,J
Kuczarow,W.

5. Division de Climatologie :

(16 travailleurs)
Chef : M. Bernard,E.
Adjoint : M. Henkes,R.

6. Division de Technologie agricole :

(10 travailleurs)
Chef : M. Roels,O.

7. Division de Phytopathologie et d'entomologie :

(100 travailleurs)
Chef : N.....
Assistants : Mme Soyer,D
MM. de Francquen,P
Henrard,P
Lefèvre,P.C.
Noureau,J
Schmitz,G.

8. Division de Génétique :

(12 travailleurs)
Chef : N.....

9. Division d'Hydrobiologie :

(10 travailleurs)

Chef : M. Hulot,A.

B. SECTION DES RECHERCHES AGRONOMIQUES.

Chef : M. Henry,J.

1. Division du Palmier à Huile : (1.006 Ha.)

(640 travailleurs)

Chef : M. Vanderweyen,R.

Assistants : MM. Berghmann,P
Miclotte,H.

Adjoints : MM. Delahaut,J
de Macar,E
Falize,A.

2. Division de l'Hevea : (485 Ha.)

(340 travailleurs)

Chef : M. Van Leer,R.

Assistant : M. Pichel,R.

Adjoints : MM. Daem,J
Mestdagh,F.

3. Division du Caféier et du Cacaoyer : (300 Ha.)

(270 travailleurs)

Chef : M. Thirion,F.

Assistant : M. Geortay,G.

Adjoints : MM. Daem,B
Denis,J
Pier,J.

4. Division des Plantes vivrières : (Superficie variable)

(200 travailleurs)

Chef : M. Henry,J.

Assistants : MM. de Bilderling,G
Muller,J
Oldenhove,H.

Adjoints : MM. Pochet,H
Van Daele,E.

III. SERVICE DES PLANTATIONS EXPERIMENTALES.

Chef : M. Braconnier,C.

1. Plantation expérimentale de Yangambi : (860 Ha.)

(500 travailleurs)

Chef : M. Mathieu,F.

Adjoints : MM. Donck,J
Govaert,R
Pier,F.

2. Plantation expérimentale de Gazi : (980 Ha.)

(680 travailleurs)

Chef : M. Van Hamme,F.

Adjoint : MM. Ectors,V.

3. Plantation expérimentale de Lula :(290 Ha.)

(320 travailleurs)

Chef : N.....

Adjoints : MM. De Ruyter,L
Schramme,A.

4. Plantation expérimentale de Barumbu : (725 Ha.)

(450 travailleurs)

Chef : M. Colart,H.

Adjoints: MM. Adriaenssens,F.
Goosse,F.

5. Centres expérimentaux d'Hévéaculture.

A. Plantation de Bongabo :(700 Ha.)

(530 travailleurs)

Chef : N.....

Adjoints : MM. Bequet,A
Close,H
Collignon,A
Dewit.

B. Plantation de Mukumari : (700 Ha.)

(530 travailleurs)

Chef : M. Carnewal,J.

Adjoints : MM. Maesen,H
De Tollenaere,P.

IV. SECTEUR DES REGIONS EST.

1. Station expérimentale de Nioka : (5.000 Ha. de pâturages +
300 Ha. cultivés
(bétail d'élevage : 2.400 têtes de bétail,
45 équidés, 30 suidés, 150 ovins et caprins, etc...)

(980 travailleurs)

Directeur : M. Rossignol,J.

Vétérinaire : Dr. Mariez,M.

Assistant : M. Van Parys,A.

Adjoints : MM. Debroux,A
Duez,R
Ranscelot,M
Van der Linden,P.

2. Laboratoire vétérinaire de Gabu:

Directeur : Dr. Deom,J.

3. Station expérimentale de Mulungu-Tshibinda :(186 Ha.)

(510 travailleurs)

Directeur : M. Hendrickx,F.L.

Assistants : MM. Henderickx,J
Liénart,J
Rigot,J.

Chimistes : MM. Chantrenne,M
Tondeur,R.

Adjoints : MM. Borin,G
Demoulin,E
Millet,M
Stevenart,J
Van Duven,M
Verschraeghe,L
Vlaeminck,E.

4. Station de Sériciculture et d'Apiculture du Mont-Hawa (Ituri)

(310 travailleurs)

Directeur : M. Belot,R.

Assistant : M. Couvreur,J

Adjoints : MM. Jacquemin,R
Allemensch
Raemaeckers
François

Mme Belot
Mme Jacquemin.

V. SECTEUR DU BAS-CONGO.

1. Station expérimentale des Plantes fruitières de Vuazi:(190 Ha.)

(265 travailleurs)

Directeur : M. Van Laere,R.

Assistant : M. Vanden Broecke,R.

Adjoint : M. Labarre,C.

2. Station d'Essais de Kondo :(300 Ha.)

(290 travailleurs)

Directeur : M. Van Laele,A.

Adjoint : M. Van Oppens,A.

3. Station d'essais de Plantes à Fibres de Gimbi-Matadi:(420 Ha.)

(400 travailleurs)

Directeur : M. Drynaert,J.

Assistant : M. Laurent,J.

Adjoint : M. Van Hoef,M.

VI. STATIONS DE SELECTION ET D'EXPERIMENTATION COTONNIERES.

1. Station expérimentale de Bambesa : (Superficie variable)

(185 travailleurs)

Directeur :	M.	Lecomte,M.
Assistants :	MM.	Colignon,E. De Coene,R Dewez,J Dubois,H.
Adjoint :	M.	Devogelaere,A.

2. Centre cotonnier de Boketa (Ubangi) :(Superficie variable)

(80 travailleurs)

Chef :	M.	Van den Eynde,G
Adjoint :	M.	Borrey,R.

3. Station expérimentale de Gandajika: (Superficie variable)

(205 travailleurs)

Directeur :	M.	Noyen,J
Assistants :	MM.	De Preter,E Maes,J Wouters,W.
Adjoint :	M.	Fontaine,J.

4. Centre cotonnier de Lubarika(Kivu) : (Superficie variable)

(130 travailleurs)

Chef :	M.	Baijot,J.
Assistant :	M.	Jacquemin,R.

VII. SECTEUR DU KATANGA.

Chef :	M.	Soyer,L.

Station du Keyberg :(en voie de réalisation)

Directeur :	M.	Soyer,L.
Assistants :	MM.	Lemarchand,G Thuriaux Van Roeckhoudt.
Adjoint :	M.	Temmerier,G.

VIII. STATION DU KWANGO (en voie de réalisation)

Directeur :	M.	Hardy,R.

IX. STATIONS DU RUANDA-URUNDI :

(sous la gestion technique de l' I.N.E.A.C.)

June 4: At Yangambi

During early coffee before breakfast, M. Jurion explains that the fundamental rights of the natives in the land are clearly recognized by the courts. Thus before one may obtain land all of these rights of the natives must be satisfied through proper payment. These include rights for timber, fishing, hunting, etc. As I understand, the amount to be paid is a matter of agreement between the natives and the purchaser. The natives must be satisfied. Even then, local administrators may decide that the villages are too crowded already and prevent the sale of land. After the native rights are paid, one may then buy or lease the land from the Government; but to keep it, plantings must be made and the land developed for use.

Many of the natives have become Christians and they content themselves with one wife. Others often take more than one wife as they accumulate property and can afford the cost and tax.

Just before breakfast a native comes up to the doorway and makes a long speech to Director Jurion with all the dignity of a senator. Jurion listens to him patiently without interruption. At the end he replies in one or two short sentences. The conference is over. Of course, all of this is in Congolese. It seems this native man has responsibility for the cleanup squad that eliminates the breeding places of malaria-carrying mosquitoes, and that some of the white people wouldn't let him into their gardens.

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After breakfast we drive to the soils laboratory at the station. I met M. Lievens, Chief of the Division of Soil Science (or Pedology, as it is always called here); M. Kuczarof, chemist; M. Fripiat, physical chemist; M. D'Hoore, mineralogist; and M. Croegaert,[a] soil surveyor.

We drive out immediately to look at the principal types of soil on the station.

The first profile we examine is in the dense forest. The land is undulating and has many termite mounds. Probably most of the material is residual from sandstone with some influence of a broad old terrace along the Congo. The site is about 8 miles from the river, north and a little east of Yangambi.

Soil Profile Sample No. 1[b]

A_0	¼ - 0"	Very thin brown leaf mold
A_1	0 - 5"	Dull brown heavy sandy loam to sandy clay loam; very little silt. Now moist and becomes sticky when worked with the fingers. In place it is loose to mellow and indistinctly granular. Many roots. Reddish-brown when dry.

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[a] He was ill most of the time I was at Yangambi.

[b] All soil color notes in this Journal are very rough. It is often very dark in the forest and in some plantations as well. And too, I often cannot use my glasses because of the heat and humidity.

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The first profile we examine is in the dense forest. The land is undulating and has many termite mounds. Probably most of the material is residual from sandstone with some influence of a broad old terrace along the Congo. The site is about 8 miles from the river, north and a little east of Yangambi.

Soil Profile Sample No. 1[b]

A_0	1" - 0"	Very thin brown leaf mold
A_1	0 - 5"	Dull brown heavy sandy loam to sandy clay loam; very little silt. Now moist and becomes sticky when worked with the fingers. In place it is loose to mellow and indistinctly granular. Many roots. Reddish-brown when dry.

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[a] He was ill most of the time I was at Yangambi.

[b] All soil color notes in this Journal are very rough. It is often very dark in the forest and in some plantations as well. And too, I often cannot use my glasses because of the heat and humidity.

A_3[/a]	5 - 14"	Transitional; somewhat more yellowish and more compact; many roots. Reddish-yellow when dry.
B_1	14 - 44"	Yellowish-orange brown heavy sandy loam; slightly compact--less so than A_3, but more so than C; a good many roots. Reddish-yellow when dry.
B_3	44 - 60"	Transitional -- not sampled.
C	60 - 72"plus	Somewhat more reddish and open than the soil above -- a very friable light sandy clay loam. Mellow indeed. Roots are found throughout the 6-foot section. Reddish-yellow when dry, but more red than B_1.

All of the soil becomes plastic and sticky when worked with the hands. For the first two feet there are many large roots with rootlets going to more than six feet. It is said that at about 15 meters one may find limonite blocks up to two meters in diameter, along with some gravel. There are said to be beds near the river of white sand with a significant percentage of heavy black minerals.

I take pictures of the vegetation and one of a termite mound that is just beginning.

From here we go to a long trench in a planting of oil palms where I get photographs of a similar soil. The men with me say the soil here is degraded a bit and somewhat more compact than in the upper B_1, but I fail to see any significant difference.

[/a] The genetic designations given to the various horizons of soil profiles covered in these notes are quite uncertain. In the majority of cases laboratory work would be necessary to establish the genetic position, if indeed it can be established at all. These designations simply represent my best hurried judgment at the time.

A_3[a]	5 - 14"	Transitional; somewhat more yellowish and more compact; many roots. Reddish-yellow when dry.
B_1	14 - 44"	Yellowish-orange brown heavy sandy loam; slightly compact--less so than A_3, but more so than C; a good many roots. Reddish-yellow when dry.
B_3	44 - 60"	Transitional -- not sampled.
C	60 - 72"plus	Somewhat more reddish and open than the soil above -- a very friable light sandy clay loam. Mellow indeed. Roots are found throughout the 6-foot section. Reddish-yellow when dry, but more red than B_1.

All of the soil becomes plastic and sticky when worked with the hands. For the first two feet there are many large roots with rootlets going to more than six feet. It is said that at about 15 meters one may find limonite blocks up to two meters in diameter, along with some gravel. There are said to be beds near the river of white sand with a significant percentage of heavy black minerals.

I take pictures of the vegetation and one of a termite mound that is just beginning.

From here we go to a long trench in a planting of oil palms where I get photographs of a similar soil. The men with me say the soil here is degraded a bit and somewhat more compact than in the upper B_1, but I fail to see any significant difference.

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Table 15. Analyses of Reddish-Yellow Latosol. (1)

Sample No.	Horizon	Depth	pH	Organic ~~Matter~~ Carbon	Size Class and Diameter of Particles (*in mm.*)							Other Classes (*in mm.*)		
					Very coarse sand 2–1	Coarse sand, 1–0.5	Medium sand, 0.5–0.25	Fine sand, 0.25–0.1	Very fine sand, 0.1–0.05	Silt, 0.05–0.002	Clay, <0.002	0.02–0.002	<0.005	>2
		Inches		*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
48630	A_1	0-5	4.9	1.1	1.2	18.1	22.1	29.8	4.8	2.2	21.8	0.8	21.9	0
631	A_3	5-14	4.6	0.5	1.3	17.4	17.4	19.3	3.8	2.6	38.2	0.8	38.4	0
632	B_1	14-44	4.7	0.3	3.4	16.8	15.7	18.4	3.9	1.8	40.0	0.5	40.1	0
633	C	60-72	4.6	0.2	2.1	18.0	18.4	20.2	3.5	2.0	35.8	0.5	35.6	0

Sample No.	Horizon	Depth	Exchangeable Cations me/100 g					Sum of Cations me/100 g	% Base Saturation	Total P	Available P
			Ca	Mg	Mn	K	H			%	ppm.
48630	A_1	0-5	0.1	0.1	<0.01	0.3	6.3	6.8	7	.038	10
631	A_3	5-14	0.1	0.1	<0.01	0.2	6.0	6.4	6	.050	4
632	B_1	14-44	0.1	<0.1	<0.01	0.2	4.8	5.1	6	.047	4
633	C	60-72	0.1	<0.1	<0.01	0.3	3.6	4.0	10	.040	4

~~Occasional horizons were not analyzed.~~

Congo Soil Profile No. 1

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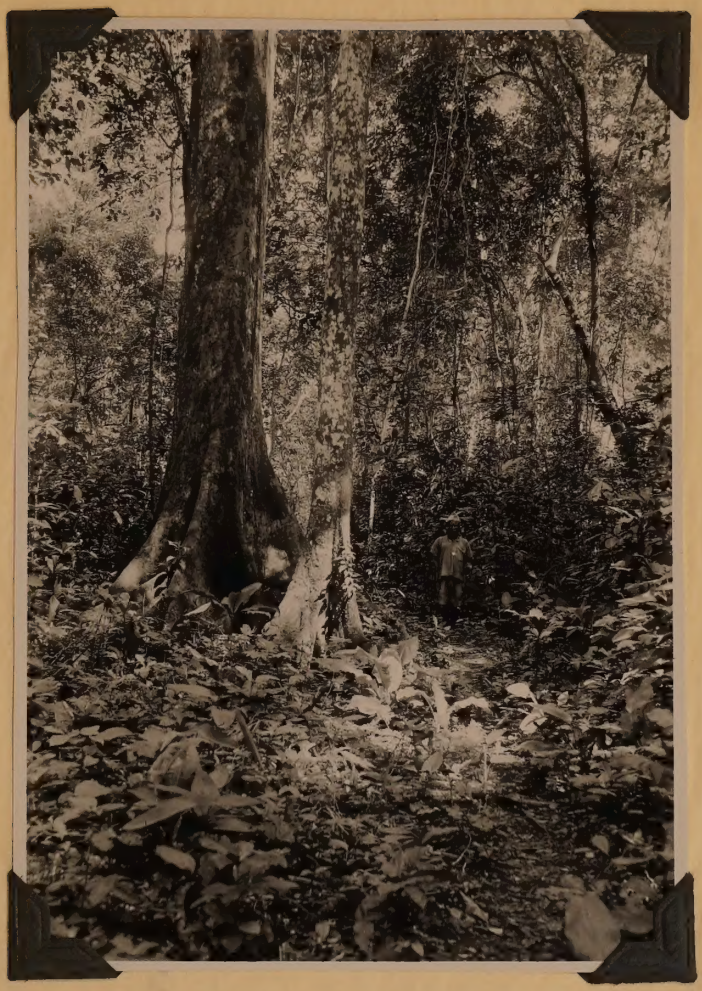
Table 17. Analyses of Reddish-Yellow Latosol. (1)

Sample No.	Horizon	Depth	pH	Organic Carbon	Very coarse sand 2-1	Coarse sand 1-0.5	Medium sand 0.5-0.25	Fine sand 0.25-0.1	Very fine sand 0.1-0.05	Silt 0.05-0.002	Clay <0.002	Other Classes (in mm.) 0.02-0.002	<0.005	>2
				pct.	pct.	pct.	pct.	pct.	pct.	pct.	pct.	pct.	pct.	pct.
48550	A1	0-5	4.9	1.1	1.3	18.1	22.1	28.8	4.8	2.3	21.8	8.8	21.9	0
551	A3	5-14	4.6	0.3	1.3	17.4	17.4	13.3	3.8	3.6	39.3	8.0	38.4	0
552	B1	14-44	4.7	0.3	3.4	16.8	12.7	13.4	3.3	7.8	40.0	0.3	40.1	0
553	C	60-72	4.6	0.3	1.3	18.0	18.4	20.3	3.2	8.0	32.8	0.3	32.6	0

Size Class and Distribution of Fractions (in mm.)

Sample No.	Depth	pH	Exchangeable Cations m.e./100 g. Ca	Mg	K	Hydrolytic Acidity m.e./100 g.	Sum of Cations Base Saturation %	Total P %	Available P ppm.
48550	0-5	4.9	0.1	<0.01	0.3	6.3	6.8	.038	10
551	5-14	4.6	0.1	<0.01	0.3	6.0	6.4	.020	4
552	14-44	4.7	0.1	<0.01	0.3	4.8	5.1	.017	4
553	60-72	4.6	0.1	<0.01	0.3	3.6	4.0	.010	4

Chaco Soil Profile No. 1



K-1364 June 3, 1947
Belgian Congo. Yangambi. View of tropical forest at site of soil profile sample No. 1.

K-136. June 3, 1947
Belgian Congo. Yangambi. View of tropical
forest at site of soil profile sample No. 1.

K-1365 June 4, 1947
Belgian Congo. Yangambi. View of tropical forest at site of soil profile sample No. 1.

K-1365 June 4, 1947
Belgian Congo. Yangambi. View of tropical
forest at site of soil profile sample No. 1.

K-1366 June 4, 1947
Belgian Congo. Yangambi. View of tropical forest at site of soil profile No. 1. Strangling Ficus. The trees will die.

K-1366 June 4, 1947
Belgian Congo. Yangambi. View of tropical
forest at site of soil profile No. 1.
Strangling Ficus. The trees will die.

K-1367 June 4, 1947
Belgian Congo. Yangambi. Small termite mound in dense tropical forest.

K-1508 June 4, 1947
Belgian Congo. Yangambi. View of dense tropical forest. (site of sample No. 1.)

K-1367 June 4, 1947
Belgian Congo. Yangambi. Small termite
mound in dense tropical forest.

K-1508 June 4, 1947
Belgian Congo. Yangambi. View of dense tropical
forest. (site of sample No. 1.)

K-1369 June 4, 1947
Belgian Congo. Yangambi. View in Hevea rubber planting, looking into old termite mound. (Bd. 5 variety of Hevea.) Present trees planted in 1938, after older ones first set out in 1911.

K-1369 June 4, 1917
Belgian Congo. Yangambi. View in Hevea rubber planting, looking into old termite mound. (Bd. 5 variety of Hevea.) Present trees planted in 1938, after older ones first set out in 1911.

K-1368 June 4, 1947
Belgian Congo. Yangambi. Trench in oil palm planting.

K-1368 June 4, 1917
Belgian Congo. Yangambi. Trench in oil
palm planting.

K-1509 June 4, 1947
Belgian Congo. Yangambi. Rubber tree.

K-1509

K-1509 June 4, 1917
Belgian Congo. Yangambi. Rubber tree.

We drive along the road to a Hevea rubber plantation where I take photographs. The first planting was made in 1911. Those trees ran their course and the present ones were planted in 1938 and a natural undergrowth allowed to cover the land. I look at the soil profile under this rubber. It is somewhat more compact in the surface and in the upper subsoil, but more loose in the deep subsoil. In fact, the boundary separating the compact upper subsoil and the loose material beneath is nearer the surface here than under the forest. I am told that this almost universally occurs at Yangambi with cultivation. One of the big problems is to prevent this granulation of the soil. Apparently the forest trees take the water out of the soil profile to considerable depth, and the ground cover of the rubber trees takes water from the surface. I notice pieces of fresh-looking charcoal at about two feet. It is possible this is carried down by insects or small animals. The soil here is considerably drier than under the forest. There is good root growth for more than three feet. The very soft mellow crumb structure is found from three feet and lower.

We go back to the soil laboratory and spread out the soil samples to dry -- and then to lunch. It is certainly hot for me. The roads here are teeming with natives, especially women carrying large baskets and bundles of fruits and other things on their heads.

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At lunch Director Jurion calls my attention to some Ground-Water Podzols near the station which I hope to see. After lunch I go to the soils laboratory where they are making routine analyses and conducting some interesting laboratory research on the soils of the vicinity. I don't find the mineralogical work particularly interesting. They had found that the primary minerals were all gone in the older soils. They are studying the clay minerals through chemical analysis, cation exchange, and with some X-ray work done in Belgium. They feel that it is more important to study the active surface, than the individual minerals, considering both the total area of surface and the kind of surface. They are using Langmuir's apparatus to study the stabilizing properties of clay on emulsions of benzine and water.

One of the most interesting studies is the dispersion of soil through the use of CCl_4. The soil is put into a tube, CCl_4 added, and the mixture shaken. Then a few drops of water are added. Then the mixture is shaken. The soil aggregates and a little more water are added and the mixture is shaken. The soil adheres to the glass walls of the tube. The stopper is removed and the clear CCl_4 is poured out. A large amount of water is then added, the tube shaken, and one has a perfect dispersion. No ammonia is needed. For very difficult subsoils, I am told that an extract of surface forest soil will peptize the clay, but the extract must be freshly prepared.

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With this technique they can compare separately the colors of the dispersed colloid and of the clean sand. They emphasize important differences in tint among the soil fractions. It is brought out that soils of different color often have clay of the same color but sands of different colors. With soil having concretions they sometimes find iron coatings on the sand particles, whereas in other soils, the fine sand may be white. Here at Yangambi some of the sands are red and some are yellow.

The productive soils here are well peptized, whereas the flocculated soils are infertile! It is thought that perhaps in the peptized soil there is much greater surface contact between soil and roots.

They are concerned with the protective force that peptizes the clay. They are trying to compare soils to find out what is required according to some standard for peptizing a pure flocculated clay. They are experimenting with Langmuir's apparatus and are also using some viscosometers to let drops of soil suspension into benzine. It is possible that the volume of the drops, under standard conditions, may be used as a measure of clay activity.

They are using the Atteberg method of sedimentation for mechanical analysis that is so standardized that it can be operated consistently by native assistants.

We have a considerable discussion about the method for

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J. FRIPIAT
J. D'Hoore

Yangambi

Ex 4.1.64

Classification.-

MATERIAUX SORBABLES SURFACES ACTIVES

- molécule
  - forme gazeuse : O_2 , N_2 , CO_2 etc..
  - forme liquide : eau monomoléculaire, composés organiques
  - solution aqueuse
    - sels, composés organiques
    - et gaz.
- polymolécules
  - forme liquide : eau bimoléculaire, composés organiques
  - solution aqueuse : composés organiques et complexes organo-minéraux.
- macro-molécules
  - solution aqueuse : protéines simples etc...
  - forme solide : cellulose, pentosanes etc...
- colloïdes peptisés
  - organiques
    - protéines complexes
    - polysaccharides complexes etc...
  - minéraux
    - argiles
    - oxydes hydratés etc...
  - complexes : organo-minéraux (peu connus)
- solides cristallisés ou amorphes.
  - colloïdes floculés.
  - minéraux
    - résidaires
      - lourds $d > 2,9$
      - légers $d < 2,9$
    - de néo-formation: ex. produits de latérisation
    - adventifs: dérivés organiques minéralisés. ex.: charbon.
- corps organisés
  - vivants : microflore, microfaune.
  - morts : résidus organiques.

SUBSTRATS

determining available phosphorus. I insist that they must buffer their acid extractant, which they are not now doing, in order to control the pH of the final solution. I also suggest that they check the relationship between the amount of available phosphorus and the time of shaking, because in lateritic soils the curve is often not a simple parabola. I give them references to the work of Truog, Heck, and others on these points.

We drive out along the margin of the river west of Yangambi. On some of the alluvial bottoms there are soils similar to our Portsmouth series.

A_0	$1\frac{1}{2}$ - 0"	Rich reddish-brown mat of roots and organic matter
A_1	0 - 18"	Dark gray loamy sand
G	18" plus	Gray sand

This soil is not used for crops. It is said to be too sandy and to have the water table too near the surface.

About 15 kilometers from Yangambi, I see a relatively immature Ground-Water Podzol with orterde. This resembles a weak Leon. Near the Lilanda River on the road to Isangi, there are some crops, including oil palm and bananas.

About a kilometer from the Congo River and some 20 kilometers west of Yangambi, I sample an alluvial soil from slack-water clays of the Congo River.

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We drive out along the margin of the river west of Yangambi. On some of the alluvial bottoms there are soils similar to our Portsmouth series.

A_0	12½ - 0"	Rich reddish-brown mat of roots and organic matter
A_1	0 - 18"	Dark gray loamy sand
G	18" plus	Gray sand

This soil is not used for crops. It is said to be too sandy and to have the water table too near the surface.

About 15 kilometers from Yangambi, I see a relatively immature Ground-Water Podsol with orterde. This resembles a weak Leon. Near the Lilanda River on the road to Isangi, there are some crops, including oil palm and bananas.

About a kilometer from the Congo River and some 20 kilometers west of Yangambi, I sample an alluvial soil from slack-water clays of the Congo River.

Soil Profile Sample No. 2

(There is no forest litter here. But the soil has not been plowed.)

A_1	0 - 3"	Grayish-brown clay with tinge of ocher. It is massive and coarsely visicular. Along cracks, tongues of A_1 extend 12 inches. Light reddish-brown when dry.
B	3 - 18"	Yellowish-brown clay; soft, plastic, and massive; breaks into indistinct subangular nuts. Pink to very pale brown when dry.
C	18 - 26" plus	Orange-brown clay; soft, plastic, and massive; crumbles a little into indistinct, subangular nuts. Light reddish-yellow when dry.

In this place the soil is used for kudzu and panicum maximum--a wild grass.

At 6 p.m. we go back to quarters. I have dinner with Director Jurion and the two Dutch. There is much discussion of monoculture for rubber, oil palm, etc., as compared to growing these crops in mixtures with trees and shrubs for shade and ground cover, as is done here. The Dutch point out that in Sumatra it would be impossible to have such a mixed culture because the swine of the natives would run about in the brush and attract the tigers and these would occasionally get a few workmen. I remember reading that in Malaya rubber must be planted in open areas because the tigers lurk in the brush and kill the natives.

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Director Jurion strongly opposes monoculture. He points

out that if beans and maize are grown together the beans will fix twice as much nitrogen. He insists that other plants should be grown with the crop plants even though these others are not commercial ones.

Jurion also stresses the fact that even though there is much rain at Yangambi there are some periods when there may be even as much as two weeks with little or no rain. In these periods the soil is inclined to dry out greatly if it is exposed to the sun.

Then after dinner we go back to the big question of why the soil at Yangambi does not respond to fertilizer. I have already suggested magnesium, especially for oil palm. Here the pH of the soils is about 4 or a little above under the forest and then goes down to 3.6 after cultivation. The Dutch agree with my suggestion and point out that a similar problem arose in the Dutch Indies. In some of their soils they could find no response to fertilizer, but good response to the spent "bunches" from the oil palm. Then they found that the ash from these bunches would do the same thing. And from that they went to the use of magnesium sulphate plus potassium sulphate. With these various treatments there was a good response to phosphates, but not without them.

It is cooler this evening. I am very tired and ready for bed even though there has not been time to write all in these notes that should have been written.

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June 5: In Yangambi

Before breakfast Director Jurion tells me a little about the cotton grown north of Yangambi. This is usually planted in monoculture within the rotation of food crops and forest. In this northern area it is planted in July in order to be ready for harvest during the dry season in November. Their best yields are about $1\frac{1}{4}$ bales of lint cotton per acre or about 1 ton of seed cotton per hectare. Of course, the actual yields gotten by the natives are considerably less than this. One of the best and most important varieties is the American cotton, Stoneville, with about 1-1/16 inch staple.

The two Dutch gentlemen are with us for breakfast and there is a good deal more talk about trade. Mr. Schuitenmaker is very critical of the United States. In fact, he shows me some pictures of the beautiful offices of his Trust with the comment that we have nothing so nice as this in Washington or other cities in the United States. I tell him that I agree, but that his offices are polished with the sweat of the Javanese. This is the end of the discussion.

After breakfast I meet M. J. Leonard, a botanist with INÉAC, and also M. J. Henry, an agronomist. I then go out to look at the rotation of food crops. These are generally a series of corridors within the forest.

In the first stage, the trees are cut but not burned. The

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K-1370 June 5, 1947
Belgian Congo. Yangambi. First stage in rotation of food crops. Trees cut but land not burned.

K-1372 June 5, 1947 Belgian Congo
Second stage in rotation of food crops. Maize was sown first. All other ground cover is of wild plants.(Site of profile sample No. 3.)

K-1370 June 5, 1947
Belgian Congo. Yangambi. First stage in rotation of food crops. Trees cut but land not burned.

K-1372 June 5, 1947 Belgian Congo
Second stage in rotation of food crops. Maize was sown first. All other ground cover is of wild plants.(Site of profile sample No. 3.)

K-1373 June 5, 1947
Belgian Congo. Yangambi. Third stage in rotation of food crops. Cassava and bananas, with bananas just beginning.

K 1373
X, 10

K-1373 June 5, 1947
Belgian Congo. Yangambi. Third stage in rotation of food crops. Cassava and bananas with bananas just beginning.

stumps and logs are left to rot in place. In the older type of farming the forest was felled and burned completely clean and then crops like kudzu, rice, peanuts, and cassava grown in pure culture. After that came kudzu fallow for one year to be followed by the same food crops until the soil became exhausted. Then the land was allowed to go back to native regrowth. If the cropping went too far the first plants were savanna grasses which the forest followed only very slowly.

In this newer system the corridors are about 2 kilometers long and 100 meters wide, alternating with similar plots of unburned forest. If a plot is left for two years after clearing, a second growth of forest appears. The cultivated crops will do better after the cutting of the second growth than they will if planted directly after the first cutting. Thus the second growth of trees is felled and burned, although the logs are left partly burned to rot. Then cultivation begins. In mixed culture, bananas are planted first; a few days later maize is planted; when the maize is about 6 inches high, rice seeds are planted; and when the rice is about two feet high, cassava is planted. The first to be mature is the maize. Then rice is harvested about four months from the beginning. When the rice is off, cassava occupies most of the land. The next harvest is cassava about 12 months from the beginning. The natural regrowth of the cassava after harvest makes a cover crop for the bananas. The

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In this newer system the corridors are about 2 kilometers long and 100 meters wide, alternating with similar plots of unburned forest. If a plot is left for two years after clearing, a second growth of forest appears. The cultivated crops will do better after the cutting of the second growth than they will if planted directly after the first cutting. Thus the second growth of trees is felled and burned, although the logs are left partly burned to rot. Then cultivation begins. In mixed culture, bananas are planted first; a few days later maize is planted; when the maize is about 6 inches high, rice seeds are planted; and when the rice is about two feet high, cassava is planted. The first to be mature is the maize. Then rice is harvested about four months from the beginning. When the rice is off, cassava occupies most of the land. The next harvest is cassava about 12 months from the beginning. The natural regrowth of the cassava after harvest makes a cover crop for the bananas. The

banana harvest begins about 18 to 24 months after the very start. For short cultures this completes the rotation and the land goes back to forest after a total of two or three years following burning. But some of the land is handled in longer rotations. For example, after harvesting bananas, the bananas and cassava may be cut down and a new planting made of maize, peanuts, and, to end the rotation, Abroma -- a textile plant something like sida. The textile crop is harvested seven years after the first burning. Thus, each cycle takes about $3\frac{1}{2}$ years within the 7-year period.

Sometimes the rotation is stopped after peanuts without the textile crop. The succession of natural regrowth following cultivation is quite different in botanical composition after (1) the short cycle, (2) the long cycle ending with peanuts, and (3) the long cycle ending with Abroma.

I look at a second plot where maize has been sown first after clearing and burning. When the maize is harvested bananas will be planted. All the ground cover will be made up of the wild plants that come in by themselves. Since February is the driest month at Yangambi, it is the best time to burn. But at such a dry time one must plant maize rather than bananas. The yield on this plot will be about 800 kilos of shelled grain per hectare. This grain is used entirely for human food in the Congo.

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Soil Profile Sample No. 3

A_0	½ - 0"	Brown organic mat. There is very little litter and some ash, but the land has not been plowed.
A_1	0 - 6"	Yellowish-brown quite mellow heavy sandy loam which becomes plastic when rubbed. There are a good many roots and insects. Reddish-brown to purplish-gray when dry.
A_3	6 - 18"	Light yellowish-brown heavy sandy loam to sandy clay loam; slightly compact but falls into poor crumb; plastic when squeezed. Light reddish-brown when dry.
B_1	18 - 40"	Like above but slightly reddish. Reddish-yellow when dry.
B_3	40 - 50"	Transitional
C	50 - 70" plus	Slightly more reddish and more friable than the soil above. Yellowish-red when dry.

Insects and roots are quite plentiful throughout the profile. The land is gently undulating with scattered termite mounds. Both landscape and profile are about the same as for soil profile No. 1.

The maize on this plot looks a little stunted. Many of the lower leaves are drying and are dull brown in color, with the brown beginning in oblong spots within the leaf. I suspect nitrogen deficiency, but also there is some evidence of potassium and magnesium deficiencies (?).

I look at a third plot with cassava and bananas, and then at a fourth plot with cassava about ready to harvest 1½ to 2 years

Soil Profile Sample No. 3

A_0	$\frac{1}{2}$ - 0"	Brown organic mat. There is very little litter and some ash, but the land has not been plowed.
A_1	0 - 6"	Yellowish-brown quite mellow heavy sandy loam which becomes plastic when rubbed. There are a good many roots and insects. Reddish-brown to purplish-gray when dry.
A_3	6 - 18"	Light yellowish-brown heavy sandy loam to sandy clay loam; slightly compact but falls into poor crumb; plastic when squeezed. Light reddish-brown when dry.
B_1	18 - 40"	Like above but slightly reddish. Reddish-yellow when dry.
B_3	40 - 50"	Transitional
C	50 - 70" plus	Slightly more reddish and more friable than the soil above. Yellowish-red when dry.

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K-1374 June 5, 1947
Belgian Congo. Yangambi. Fourth stage in rotation of food crops - 1½ to 2 years after start. About ready to harvest cassava.

Soil Profile Sample No. 3

A_0	½ - 0"	Brown organic mat. There is very little litter and some ash, but the land has not been plowed.
A_1	0 - 6"	Yellowish-brown quite mellow heavy sandy loam which becomes plastic when rubbed. There are a good many roots and insects. Reddish-brown to purplish-gray when dry.
A_3	6 - 18"	Light yellowish-brown heavy sandy loam to sandy clay loam; slightly compact but falls into poor crumb; plastic when squeezed. Light reddish-brown when dry.
B_1	18 - 40"	Like above but slightly reddish. Reddish-yellow when dry.
B_3	40 - 50"	Transitional
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K-1374 June 5, 1947
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K-137. June 5, 1947
Belgian Congo. Yangambi. Fourth stage in rotation of food crops - 1½ to 2 years after start. About ready to harvest cassava.

K-1375 June 5, 1947
Belgian Congo. Yangambi. Fourth stage in rotation of food crops - about 2 years after start. Cassava now being harvested.

K-1375 June 5, 1947
Belgian Congo. Yangambi. Fourth stage in rotation of food crops - about 2 years after start. Cassava now being harvested.

K-1376 June 5, 1947 Belgian Congo
Yangambi. Third stage in rotation of food crops.
Cassava and bananas.

K-1378 June 5, 1947 Belgian Congo.
Yangambi. A variation in rotation of food crops.
Instead of maize had a milo-like cereal-Coix lacryma jabi-then peanuts after bananas, a few of of which were left for selection. 4½ years after start.

K-1376 June 5, 1917 Belgian Congo
Yangambi. Third stage in rotation of food crops.
Cassava and bananas.

K-1378 June 5, 1917 Belgian Congo.
Yangambi. A variation in rotation of food crops.
Instead of maize had a milo-like cereal-Coix
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of which were left for selection. 1½ years after
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K-1377 June 5, 1947
Belgian Congo. Yangambi. Third stage in rotation of food crops. Cassava and bananas. Note common medium-sized termite mound

K-1377 June 5, 1947
Belgian Congo. Yangambi. Third stage in rotation of food crops. Cassava and bananas. Note common medium-sized termite mound

after the beginning. Nearby I see another example of bananas and cassava with the cassava just now being harvested. After this harvest the second regrowth of cassava will serve as ground cover for the growing bananas. I look at the profile in this plot. The only conspicuous feature is that the mellow C horizon is somewhat nearer the surface. Below 2½ feet the soil is highly flocculated and mellow. This flocculation, as compared to the soil in the forest, is said to indicate degeneration following cultivation!

I look at a plot just after the beginning of the second cycle, although in this case, instead of maize, is a crop something like milo -- a cereal called Coix lacryma jabi. We see the land in peanuts now following this cereal. A few good bananas have been left for selection. This plot is 4½ years after burning.

I look at a plot 3½ years after burning just before peanuts in the cycle. Here are specimen bananas left for selection, Coix lacryma jabi, second growth of cassava, and some velvet beans.

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I look at a plot 3½ years after burning just before peanuts in the cycle. Here are specimen bananas left for selection, Coix lacryma jabi, second growth of cassava, and some velvet beans.

Soil Profile Sample No. 4

The soil here is similar to profile No. 3 and on gently undulating relief.

A_1	0 - 4"	Grayish-brown sandy loam (pH is said to be 4.5). Brown when dry.
A_3 (or A_2)	4 - 10"	Yellowish-brown sandy clay loam. Reddish-yellow when dry.
B_1	10 - 24"	Light yellowish-brown sandy clay loam with some compaction. Reddish-yellow when dry.
B_3	24 - 41"	Like above but less compact. Reddish-yellow when dry.
C	41 - 60" plus	Somewhat more pinkish sandy clay loam. Mellow. Reddish-yellow to pink when dry.

The soil below A_1 is quite sticky and plastic and contains more clay than profile No. 3. Since most of the plants growing here are shallow-rooted there are very few roots below 2 feet, but insects occur throughout the profile.

(This is turning out to be a very hot day and I have to get along without my glasses.)

I now look at a regeneration plot $3\frac{1}{2}$ years since cultivation. The soil here is somewhat more sandy than the previous one; the A_1 is a little grayer and the mellow substratum begins at 18 inches.

It is now time for lunch. It is extremely hot for me in these profile pits. I almost can't take it. I go th the doctor's house for lunch which is very pleasant. Earlier the doctor's wife was a little excited because one of her pigs "eloped."

Soil Profile Sample No. 4

The soil here is similar to profile No. 3 and on gently undulating relief.

A_1	0 - 4"	Grayish-brown sandy loam (pH is said to be 4.5). Brown when dry.
A_3 (or A_2)	4 - 10"	Yellowish-brown sandy clay loam. Reddish-yellow when dry.
B_1	10 - 24"	Light yellowish-brown sandy clay loam with some compaction. Reddish-yellow when dry.
B_3	24 - 42"	Like above but less compact. Reddish-yellow when dry.
C	42 - 60" plus	Somewhat more pinkish sandy clay loam. Mellow. Reddish-yellow to pink when dry.

The soil below A_1 is quite sticky and plastic and contains more clay than profile No. 3. Since most of the plants growing here are shallow-rooted there are very few roots below 2 feet, but insects occur throughout the profile.

(This is turning out to be a very hot day and I have to get along without my glasses.)

I now look at a regeneration plot 3½ years since cultivation. The soil here is somewhat more sandy than the previous one; the A_1 is a little grayer and the mellow substratum begins at 18 inches.

It is now time for lunch. It is extremely hot for me in these profile pits. I almost can't take it. I go to the doctor's house for lunch which is very pleasant. Earlier the doctor's wife was a little excited because one of her pigs "eloped."

K-1379 June 5, 1947
Belgian Congo. Yangambi. Stage just before peanuts in rotation of food crops. $3\frac{1}{2}$ years since burning at start. Have bananas for selection, Coix, second growth cassava, and some velvet beans. (Site of profile sample No. 4.)

K-1379 June 5, 1947
Belgian Congo. Yangambi. Stage just before
peanuts in rotation of food crops. 3½ years
since burning at start. Have bananas for
selection, Coix, second growth cassava, and
some velvet beans. (Site of profile sample
No. 4.)

K-1380 June 5, 1947
Belgian Congo. Yangambi. Regeneration just beginning in rotation of food crops after bananas and cassava.

K-1380 June 5, 1917
Belgian Congo. Yangambi. Regeneration just beginning in rotation of food crops after bananas and cassava.

After lunch we go back to the field and look at a regeneration plot three years after cropping. It is important that in cultivation the cover be not removed completely from the old termite mounds so that the wild vegetation may spread out from these as well as from forest corridors. In this plot the important vegetation now is second-growth cassava and ~~Afkamonmum~~ Aframomum. There are also some three-year old umbrella trees. These are of the greatest importance because after 10 years of umbrella trees the soil is suitable for cultivation again.

I then examine a plot with regrowth starting from the forest corridor 1½ years after cultivation. The first step in regeneration here is Paspalum -- a grass, then Mikania -- an herbaceous vine, and then ~~Afkamonmum~~ Aframomum. Here the umbrella trees cannot be expected within five years after the end of cultivation. This fallow, with the cultivation ending with peanuts, is very slow and requires at least 12 years before the land is again ready for cultivation.

I then look at a regeneration plot where the cultivation stopped with the fiber plant -- Abroma. Since there is an immediate second growth of the fiber plant as a shrub, Paspalum and Mikania do not come in. The shrub is followed by trees, including umbrella trees, which come in rapidly. Thus here, regeneration can be accomplished in 10 years. I note that the vegetation not only is more advanced as to species in the succession, but also

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K-1381 June 5, 1947
Belgian Congo. Yangambi. Three years after end of planting in rotation of food crops. Note umbrella trees (best fallow plant here) 3 years old in background on termite mound. Trees left on termite mounds speed regeneration. In foreground second growth cassava and ~~Afrikamomum~~ Aframamum.

K-1381 June 5, 1947
Belgian Congo. Yangambi. Three years after end of planting in rotation of food crops. Note umbrella trees (best fallow plant here) 3 years old in background on termite mound. Trees left on termite mounds speed regeneration. In foreground second growth cassava and Aframomum.

K-1382 June 5, 1947
Belgian Congo. Yangambi. 7½ years after burning in rotation of food crops. Regeneration 1½ years after peanuts. Regeneration starting from forest strip in background. First in the grass - Paspalum - then an herbaceous vine - Mikania, followed by ~~Afrikamomum~~ Aframomum, with umbrella trees after 5 years from start of fallow. This is an example of slow regeneration after relatively long cropping, and requires 12 years before soil is ready for crops again.

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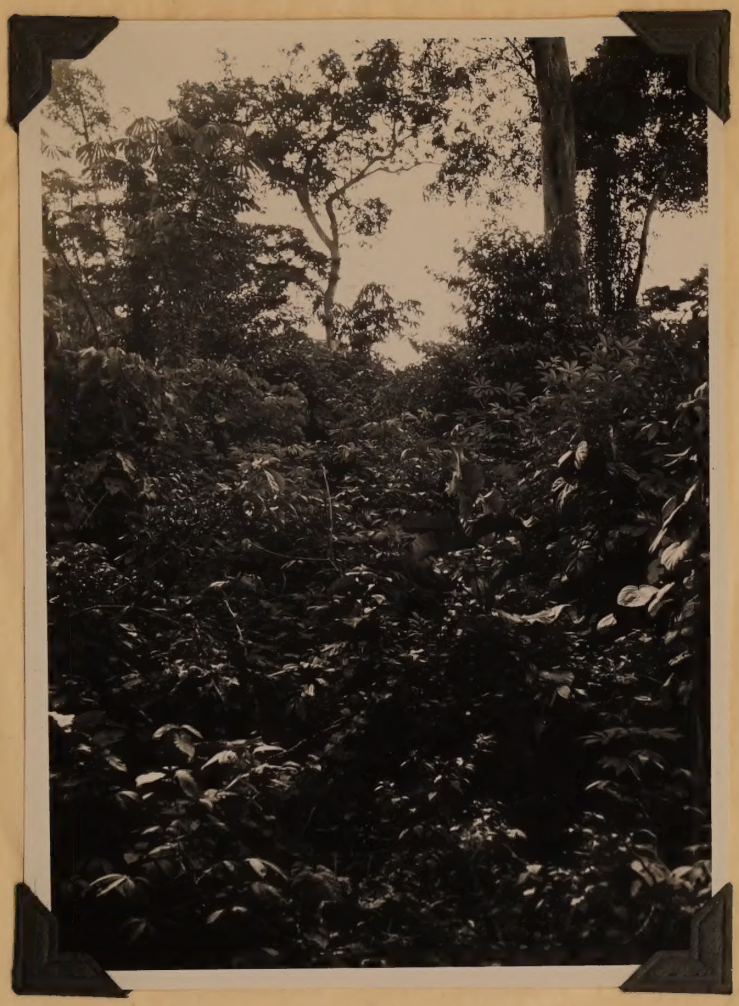
K-1382 June 5, 1947

Belgian Congo. Yangambi. 7½ years after burning in rotation of food crops. Regeneration 1½ years after peanuts. Regeneration starting from forest strip in background. First in the grass - Paspalum - then an herbaceous vine - Mikania, followed by Hyparrhenia, with umbrella trees after 5 years from start of fallow. This is an example of slow regeneration after relatively long cropping, and requires 12 years before soil is ready for crops again.



K-1383 June 5, 1947
Belgian Congo. Yangambi. Regeneration 1½ years after cropping. Here cultivation ended with a fiber plant - Abroma - which makes an immediate second growth so the period of Paspalum and Mikania is omitted. Thus trees, including umbrella trees, come more quickly and the fallow only takes 10 years. Note better growth than in K-1382 with the same time since cultivation ceased.

K-1383 June 5, 1947
Belgian Congo. Yangambi. Regeneration 1½ years after cropping. Here cultivation ended with a fiber plant - Abroma - which makes an immediate second growth so the period of Pseudum and Mikania is omitted. Thus trees, including umbrella trees, come more quickly and the fallow only takes 10 years. Note better growth than in K-1382 with the same time since cultivation ceased.

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I look at a plot in the old native short cycle -- called the Turumbu system. Here bananas, rice, maize, and other crops are planted together. Since the natives do little weeding, regeneration begins immediately after the three years of cultivation. (Unfortunately it begins to rain but I must finish these plots.) In this native cycle the umbrella trees come on the land within five years after the beginning of cultivation or two years after the end, so a 10-year fallow will restore the land.

I next look at a plot 1-3/4 years after six years of cultivation ending with peanuts. This is the poorest plot and has the slowest regeneration. The land is now occupied mainly with Paspalum and Erigeron. I look at the soil on this plot.

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K-1384 June 5, 1947
Belgian Congo. Yangambi. Regeneration after 3 years in the native (Turumbu) short cycle rotation with 3 years of mixed food crops, mostly bananas, maize, and rice. Since natives do little weeding in this system, regeneration is rapid. (Umbrella trees come in after 2 or 3 years and forest fallow restores productivity of soil in 10 years.)

K-1381 June 5, 1947.
Belgian Congo. Yangambi. Regeneration after
3 years in the native (Turumbu) short cycle
rotation with 3 years of mixed food crops, mostly
bananas, maize, and rice. Since natives do little
weeding in this system, regeneration is rapid.
(Umbrella trees come in after 2 or 3 years and forest
fallow restores productivity of soil in 10 years.)

K-1385 June 5, 1947
Belgian Congo. Yangambi. Regeneration after 1-3/4 years since 6 years of cropping ending with peanuts. The principal plants are Paspalum and Erigeron. This is the slowest cycle. The soil is left in a very low state of productivity and regeneration is very slow. (Site of profile sample No. 5)

K-1385 June 5, 1947

Belgian Congo. Yangambi. Regeneration after 1-3/4 years since 6 years of cropping ending with peanuts. The principal plants are Paspalum and Eriperon. This is the slowest cycle. The soil is left in a very low state of productivity and regeneration is very slow. (Site of profile sample No. 5)

Soil Profile Sample No. 5

A_P	0 - 4"	Loose, light grayish-brown sandy loam. Reddish-brown to purplish-gray when dry.
A_3	4 - 9½"	Yellow sticky sandy clay; slightly compact. Light brown to reddish-yellow when dry.
B_1	9½ - 22"	Somewhat lighter yellow sandy clay; only slightly compact. Light brown to reddish-yellow when dry.
B_3	22 - 40"	Transitional; loose. Reddish-yellow to pink when dry.
C	40 - 60" plus	Loose mellow sandy clay loam with slight reddish tinge. Reddish-yellow when dry.

Most of the roots are in the surface 18 inches although a few go to 50 inches. There are insects throughout the profile.

After these grass-like plants, shrubs will come in very slowly, but umbrella trees cannot be expected for another six years. This fallow must last at least 14 years.

I look at the vegetation in a recently abandoned road. First come the grasses and then ~~Aframomum~~ Aframomum.

At four o'clock I go back to Director Jurion's house and we start out for a short trip before dinner. We drive east through an old rubber plantation along the main road down to the very edge of the Congo River. We pass through a beautiful botanical garden and on to a high hill at the edge of the river. This hill is being landscaped in the English manner and ultimately many of the homes of the scientists and all of the main laboratories

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B_1	9½ - 22"	Somewhat lighter yellow sandy clay; only slightly compact. Light brown to reddish-yellow when dry.
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Table 16. Analyses of Reddish-Yellow Latosol (cropped). (5)

Sample No.	Horizon	Depth	pH	Organic ~~Matter~~ Carbon	Size Class and Diameter of Particles (*in mm.*)							Other Classes (*in mm.*)		
					Very course sand 2–1	Coarse sand, 1–0.5	Medium sand, 0.5–0.25	Fine sand, 0.25–0.1	Very fine sand, 0.1–0.05	Silt, 0.05–0.002	Clay, <0.002	0.02–0.002	<0.005	>2
		Inches		*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
48647	A_p	0–4	4.8	1.2	1.4	23.5	26.0	25.4	3.8	1.6	18.3	0.4	18.3	0
648	A_3	4–9½	4.5	0.5	1.6	19.7	21.0	23.4	4.2	2.3	27.8	0.5	27.9	0
649	B_1	9½–22	4.4	0.4	1.9	17.9	18.5	21.9	4.4	2.0	33.4	0.6	33.4	0
650	B_3	22–40	4.6	0.2	2.3	18.1	19.7	23.4	4.3	2.2	30.0	0.5	30.1	0
651	C	40–60+	4.8	0.2	1.3	16.6	21.6	25.9	4.0	2.4	28.2	0.7	28.5	<0.5

			Exchangeable Cations me/100 g					Sum of Cations	% Base Saturation	Total P	Available P
			Ca	Mg	Mn	K	H	me/100 g		%	ppm.
48647	A_p	0–4	0.8	0.2	0.03	0.1	6.0	7.1	16	.037	6
648	A_3	4–9½	0.4	0.2	<0.01	<0.1	4.9	5.5	11	.040	6
649	B_1	9½–22	0.1	<0.1	<0.01	<0.1	4.9	5.0	2	.040	8
650	B_3	22–40	0.1	0.1	<0.01	<0.1	3.6	3.8	5	.035	7
651	C	40–60+	0.1	<0.1	<0.01	<0.1	3.3	3.4	3	.035	7

Congo Soil Profile No. 5

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Table 15. Analyses of Reddish-Yellow Latosol (cropped). (2)

Sample No.	Horizon	Depth	pH	Organic Carbon	Very coarse sand 2-1	Coarse sand 1-0.5	Medium sand 0.5-0.25	Fine sand 0.25-0.1	Very fine sand 0.1-0.05	Silt 0.05-0.002	Clay <0.002	Total N	Available P	Ca	Mg	K	Exchangeable Cations m.e./100 g.	Base Saturation
48547	A	0-4	4.8	1.5	1.4	2.3	0.8	4.8	2.8	1.8	18.2	0.071	5	0.1	0.0	0.1	0.2	1
648	AB	4-18	4.2	0.5	1.3	1.7	0.9	4.3	4.4	2.3	27.3	.040	2	0.0	0.0	0.1	0.1	1
650	B	18-40	4.6	0.4	1.3	1.8	1.7	4.8	4.2	3.0	32.4	.040	2	0.0	0.0	0.1	0.1	1
651	C	40-80+	4.8	0.3	1.3	2.3	2.7	4.3	4.3	3.3	30.1	.032	2	0.0	0.0	0.1	0.1	1

Some Soil Profile Nos. 5

K-1386 June 5, 1947
Belgian Congo. Yangambi. Viewof an abandoned road to Bengamisa. Grasses come first, then ~~Afkamommum.~~ Aframomum. Beautiful umbrella trees in background.

K-1386 June 5, 1917
Belgian Congo. Yangambi. View of abandoned road to Bongamisa. Grasses come first, then Alchornea. Beautiful umbrella trees in background.

K-1387 June 5, 1947
Belgian Congo. Yangambi. Present temporary soil science laboratory.

K-1387 June 5, 1947
Belgian Congo. Yangambi. Present
temporary soil science laboratory.

will be located here. One of the laboratories is already built. They are to be large beautiful structures. We drive out into an enormous experimental forest where studies are conducted regarding the ecology of species, their light needs, etc. There are large experiments with trees planted under different conditions of spacing, light, and competition. There are also many collections of grasses, palms, and native fruits. (Safa is a very promising one.) Then there are also great areas of virgin forest for study. The forest has wild monkeys and elephants in it. I look at one leguminous tree -- Pachyelasma, some 9 meters in circumference. The trunk alone is about 23 meters high. I see some tung plantings but they are rather badly damaged here by rust diseases.

We then go back to the river and take a trip in a motor launch. The water is slightly brown. We go around some of the young islands. These begin with an accumulation of alluvium. Then a floating mat of grass develops over the sand which catches the clay fragments. The grasses are followed by shrubs and these in turn by trees.

It is nearly dark when we land some distance below Yangambi near the place where bricks are made for station buildings. I see a herd of small black and black-and-white cattle about 3 feet in height and weighing about 200 to 250 kilos apiece. These belong with the Dahomey breed from the West Coast. They seem to do well

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K-1510 June 5, 1947
Belgian Congo. Yangambi. Islands in the Congo from boat.

K-1511 June 5, 1947
Belgian Congo. Yanbambi. Young island in Congo River. The floating mat of grass catches the sand.

K-1510 June 5, 1917
Belgian Congo. Yangambi. Islands in the
Congo from boat.

K-1511 June 5, 1917
Belgian Congo. Yambambi. Young island in
Congo River. The floating mat of grass
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here on the river terrace but will not thrive on the higher terraces or the plateau. Minerals in the pasture?

During dinner we have a long discussion about the nitrogen cycle in this area. Current figures suggest that the rains bring about 15 kilograms of nitrogen, as NO_3, per hectare. The figure for Belgium is about 12 kilograms per hectare. I suggest that these figures may be low, because I suspect that there may be a large amount of absorption of ammonia by the moist soil after rains as the air returns to the soil. Air movement in and out of the soil is large and frequent in lateritic soils of humid tropics.

This has been a long day and ends with a hard tropical rain shortly after nine o'clock.

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This has been a long day and ends with a hard tropical rain shortly after nine o'clock.

June 6: Yangambi to Bambesa

We are up early for the trip to Bambesa. There was a long hard rain last night and it is still cloudy, warm, and humid. We leave at 7:45 with baggage, two extra tires, a barrel of gas, a supply of oil, extra springs, food, water, blankets, and two native boys. We take the same road to Bengamisa that we came over June 3.

M. Jurion explains that at the station it takes 50 to 60 man days per hectare to cut down the forest, or a total of 75 man days per hectare to prepare the land for food crops. But when the land is prepared for industrial crops like rubber or oil palm, 400 to 550 man days per hectare are necessary. Ordinarily a man costs $6 or $7 per month in addition to medical service, housing, blankets, severance pay, etc.

Some of the native communities are now using the strip or corridor system. The clearing and land preparation are done by the group as a whole, but each family has its own plots. A native may sell through the cooperative. Part of the sale price goes directly to the native, a part to a social fund for building houses, etc., and a part is held as a sort of saving or "caissé d'epepargne". In this region the natives belong to the Turumbu tribe. They were originally hunters but are doing well with this system of management and village cooperatives. Here the work with the natives is done largely by INÉAC itself. Some people of the Advisory Service,

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K-1388 June 6, 1947
Belgian Congo. Northeast of Yangambi in forest. Removing trees tipped into the road by wild elephants the previous night. Heavy tropical forest in light rain.

K-1388 June 6, 1947
Belgian Congo. Northeast of Yangambi
in forest. Removing trees tipped into the
road by wild elephants the previous night.
Heavy tropical forest in light rain.

however, take too conservative a view regarding the possibilities of teaching natives cooperation and good husbandry. This cooperative system permits orderly marketing. When prices are high more money is placed in the savings fund, and when prices are low, some of the reserve fund is given to the natives.

It is a big problem to teach the natives how to use their increased funds. They are first encouraged to improve the community and later to improve their individual situation, but the whole development is a very slow process.

Up until now the price of cotton has been fixed by the Government and managers were required to purchase all native cotton offered for sale but this system is now changing gradually to purchase and sale through cooperatives.

In the road through the forest we need to stop several times while the natives clear out trees pushed across the road by elephants following the heavy rain. At some of these stops I can hear monkeys chattering in the trees but don't see any. We also see a few natives in the forest hunting with long spears. I notice that the small termite mounds are collected and piled along the road for use as surface metal. Some of these small termite mounds, when full of termites, are given to the chickens for food.

Near Bengamisa we enter the area of the Bamanga tribe who are not quite so good workers. We turn north and in about 20 kilometers come into the area of the Bangelima tribe. The soil is redder.

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I see several large plantings of oil palms. Cotton is planted here in the rotation after peanuts and maize. Near the road much of the soil is overcultivated, crops are poor, and grass and other weeds come in as cover. A considerable area here is a complex of orange-red soil on the uplands and sandy alluvial soils in the valleys. Road cuts through the old termite mounds stand nearly vertical, like loess. Below Bahume I look hurriedly at the soil in the road cut. The surface is slightly pinkish medium-gray light sandy loam. This is underlain with orange-red fine sandy clay in the substratum. There are no visible concretions. The land is gently rolling and the soil belongs in the same family as those described under soil profile sample No. 1. Food crops and some oil palm are produced.

Among the natives along the road one sees now and then an albino with white skin and blond hair.

It continues to rain. The road is wet and slippery. We shall have a long trip today. On the Air Force maps only a small proportion of the villages is shown. There is no way to tell how they chose the ones to show. Many of the large ones are left off and many tiny ones indicated.

Between Mamboa and Banalia the soil is not quite so red. But after Banalia there is again a large area of orange-red soil on an undulating plain. The road is quite good considering the rain. It is well graded and kept in good repair by hand labor. Most

of these country roads have been built fairly recently and too many of the natives have settled along them. They need to move back and adopt the corridor system of rotation to avoid serious overcropping and deterioration of the soil right along the road. The crops consist mainly of food crops, oil palm, and native-grown rubber. There are also some commercial coffee plantations far from the road. After crossing the Aruwimi River at Banalia on a modern flat boat, we stop for lunch, partly because the car stalls on account of some foreign matter in the carburetor or feed line. Much of the soil is a yellowish-brown sandy loam on a nearly smooth plain.

The car is soon fixed and we go north through one little village after another. The roads are full of goats and chickens in the villages. The car driver slows down for the goats, which are a terrible nuisance, but not for the chickens.

At Bolela we pass a large cotton purchasing center. Of course, there is no cotton to be seen now since it is to be planted in a few weeks for marketing in November and December. Some of the soil here is an orange-red heavy sandy loam.

We are now in the area of the Abaka tribe. This is a very important one and their area extends all the way to Bambesa. (M. Jurion says the natives here are full of noise but good workers.) M. Jurion is now in a great hurry to reach Bambesa before dark because of the wet roads.

At Bobenge we pass an area of orange-red soil with a sandy loam surface and a gravelly sandy clay loam subsoil. This soil contains some red sandy concretions. M. Jurion says that we can examine it in detail tomorrow. He regards this soil as a good one for food crops as well as for coffee, cacoa, and oil palm. Along here we see some leopard traps baited with goats.

We pass Kole. The land here is well populated along the road as before. The houses are somewhat better looking. The natives have planted more ornamentals around their homes. The soil is a little more red. Along the streams one sees small areas of yellow sandy clay. About 20 kilometers north of Kole we pass a robusta coffee plantation. Transportation here is too difficult for commercial oil palm although some is grown by the natives for home use. This landscape continues for a long way and we drive very hard to reach Buta before five o'clock when the gas stations close. As we approach Buta the soil is considerably deeper red in color. Along here I see some nearly pure stands of umbrella trees -- the soil builders of the Congo. Unfortunately they do not grow on land more than 1,000 meters in elevation. For some distance here one has the impression of driving through a great park. There is a gradual increase in the amount of grass in the roadside and in the fallows.

We reach Buta (elevation over 2,000 feet and rainfall about 58 inches) at 4:25 p.m. and leave immediately after the car is

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serviced. As we go east there is still more grass, partly from overcropping, especially near the town. Just east of Buta we go through an area of yellowish soil and then again back to orange-red. Along here perennial living trees are used for telephone poles. I presume termites would soon destroy ordinary ones. (Just now our native driver gets a chicken. There had been so many near misses that I had begun to think they all had charmed lives. Certainly they learn to be quick.)

Of course, one sees natives along the roads all the time. Many of the native girls have nice forms. Their backs are straight and they have good poise from carrying heavy burdens balanced on their heads.

We pass through patches of light yellowish-brown soil, orange-red (ocher), and red. There are many very large termite mounds, especially on the orange-red soil. They seem to go after all sorts of woody materials. Lots of those near the highway are about 6 to 7 feet across and 6 to 10 feet high.

As we go east I see patches of cogongrass (Imperata) which spreads by rhizomes. M. Jurion says that once cropping has gone so far that this grass comes in, cultivation is finished for a very long time since it is difficult for trees to establish themselves, or even the better savanna grasses. Although we are still in the tropical rain forest, the vegetation is less dense and the country more open. Ever since passing Tele there has

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(There goes another chicken!)

About 70 kilometers from Buta the soil becomes gently rolling. About six o'clock we pass Kumu. The soil is dark red. I see some coffee plantations. Ever since a few kilometers before Buta, I notice that the natives live more individually as family groups rather than in large villages. We pass some small coffee plantations here, and the coffee is grown without shade. At 6:45, a few kilometers from Titule, it becomes so dark that I am unable to write anymore. We are now near the boundary between forest and the savanna with forest galleries.

At 7:40 p.m. we arrive at the Bambesa Experiment Station--565 kilometers from Yangambi. This day has been comfortable and is now delightfully cool. We have dinner with M. Lecomte, (director of this station) and Mme. Lecomte. We have a nice dinner and I have a comfortable room for the night. ((I am learning to ignore cockroaches, lizards, etc. that crawl around on the floor and up the walls.)

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June 7: At Bambesa[a]

This experiment station has 1,000 hectares and laboratories for soil science, plant pathology, botany, and entomology. It was established in 1922.

I go over the plots with M. Jurion, M. Lecomte, and M. DuBois, in charge of the experimental fields. Here the termites are very bad. Steel telephone poles need to be used. Many of the roads are lined with a common leguminous tree -- Leucaena glauca. On the way I stop to take some pictures of the elephants used for power on this farm.

Generally, the land is undulating to gently rolling old peneplain terrace. The soils are distinctly red, probably "Red Loam". Although there is more rainfall here than at Yangambi, there is a three months dry season with very little rain.

I first look at the soil in a second-growth forest some 15 to 20 years old following very old native farming. It is extremely dark in the woods and again too warm for glasses.

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[a] Elevation about 640 meters, and total annual rainfall about 72 inches, but with a dry season.

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Table 7. Analyses of Earthy Red Latosol (forest). (6)

Sample No.	Horizon	Depth	pH	Organic ~~Matter~~ Carbon	Size Class and Diameter of Particles (*in mm.*)							Other Classes (*in mm.*)		
					Very coarse sand 2–1	Coarse sand, 1–0.5	Medium sand, 0.5–0.25	Fine sand, 0.25–0.1	Very fine sand, 0.1–0.05	Silt, 0.05–0.002	Clay, <0.002	0.02–0.002	<0.005	>2
		Inches		*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
48654	A_1	0–2	5.6	3.0	4.0	6.8	6.1	13.3	5.6	11.1	53.1	7.5	56.0	<0.5
655	A_2	2–6½	5.1	1.4	5.9	6.6	5.2	12.2	5.3	9.9	54.9	6.5	57.5	1
656	A_3	6½–18	5.0	0.7	4.5	5.3	3.6	8.4	4.1	7.7	66.4	5.3	68.2	2
657	B_2	18–38	5.3	0.5	5.2	4.2	2.9	7.6	3.9	8.1	68.1	5.8	70.4	2
658	B_3	38–50	5.4	0.5	6.2	3.8	2.8	8.0	4.1	8.6	66.5	5.9	68.7	4
659	C_1	50–60+	5.8	0.2	13.0	5.6	3.0	6.9	4.5	9.8	57.2	6.4	59.7	7.3

Sample No.	Horizon	Depth	Exchangeable Cations me/100 g					Sum of Cations me/100 g	% Base Saturation	Total P	Available P
			Ca	Mg	Mn	K	H			%	ppm.
48654	A_1	0–2	8.1	1.8	0.07	0.7	9.8	20.5	52	.069	10
655	A_2	2–6½	1.7	0.5	0.07	0.4	11.2	13.9	19	.061	10
656	A_3	6½–18	1.5	0.3	0.03	0.4	8.8	11.0	20		
657	B_2	18–38	1.5	0.5	0.01	0.4	7.9	10.3	23	.062	5
658	B_3	38–50	1.1	0.4	0.01	0.5	8.7	10.7	19		
659	C_1	50–60+	0.9	0.4	0.01	0.7	6.6	8.6	23	.055	4

Congo Soil Profile No. 6

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Congo Soil Profile No. 6

(Form 1)

| Sample No. | Horizon | Depth | pH | Organic matter | Very coarse sand 1-2 | Coarse sand 0.5-1.0 | Medium sand 0.25-0.5 | Fine sand 0.05-0.25 | Silt 0.002-0.05 | Clay <0.002 | Size Class and Dispersion Factor (in mm.) | | |

Soil Profile Sample No. 6

A_{00}	2 - ¼"	Brown, partially decomposed leaves.
A_0	¼ - 0"	Granular mull. Dark red. Moist.
A_1	0 - 2(3)"	Dark reddish-brown clay. Fairly granular and porous. Purplish-red when dry (4/4/10R).
A_2	2 - 6½"	Like the above but somewhat lighter in color with less organic matter. Strong red when dry.
$A_{3(?)}$	6½- 18"	Easily friable red clay; plastic when rubbed. Porous in place. Strong red when dry, brighter than A_2.
$B_{1(?)}$	18 - 38"	Like the above but fairly compact. Like above when dry.
B_3	38 - 50"	Friable red clay. Strong red when dry.
C_1	50 - 60" plus	Very red gravelly mass of soil material with particles from gravel size up to small boulders. Between these stones is friable soil. Red when dry.

There are small nearly black concretions in upper solum. The whole profile is moist. There are roots throughout although they are concentrated in the upper 12 inches. The pit has been freshly made and moisture drips from the ends of the cut roots.

I then go out to look at some of the plots of food crops in the experimental fields which were cleared from the forest only a little over a year ago. Maize on land cleared last year looks good and might run as much as two tons to the acre. The maize is planted in March and harvested in July at the same time that cotton is planted. The maize stalks are left on the ground

Soil Profile Sample No. 6

A_{00}	2 - $\frac{1}{2}$"	Brown, partially decomposed leaves.
A_0	$\frac{1}{2}$ - 0"	Granular mull. Dark red. Moist.
A_1	0 - 2(3)"	Dark reddish-brown clay. Fairly granular and porous. Purplish-red when dry (4/4/10R).
A_2	2 - 6$\frac{1}{2}$"	Like the above but somewhat lighter in color with less organic matter. Strong red when dry.
$A_3(?)$	6$\frac{1}{2}$- 18"	Easily friable red clay; plastic when rubbed. Porous in place. Strong red when dry, brighter than A_2.
$B_1(?)$	18 - 38"	Like the above but fairly compact. Like above when dry.
B_3	38 - 50"	Friable red clay. Strong red when dry.
C_1	50 - 60" plus	Very red gravelly mass of soil material with particles from gravel size up to small boulders. Between these stones is friable soil. Red when dry.

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K-1512 June 7, 1947
Belgian Congo. Bambesa. Work animals used at experiment station.

K-1512 June 7, 1917
Belgian Congo. Bambesa. Work animals used at experiment station.

K-1389 June 7, 1947
Belgian Congo. Bambesa. View of forest at site of soil profile sample No. 6- a "Red Loam."

K-1389 June 7, 1947
Belgian Congo. Bambesa. View of forest at site of soil profile sample No. 6- a "Red Loam."

for mulch. Some maize is grown with four months later planting, but, of course, it doesn't get off the land in time for cotton.

The surface of the ground is covered with red concretions. I look at the soil on a low knoll of about 3 percent slope, which might be considered an oromorphic associate of the one just described. The land has been cleared one year. The peanuts and maize are growing well, but not the rice. This is said to be a good soil for cotton.

Soil Profile Sample No. 7

A_1	0 - 1½"	Very dark reddish-brown to nearly black gravelly loam.
A_2	1½ - 6"	Reddish and grayish-brown gravelly loam. Purplish-red to red when dry.
A_3	6 - 24"	Reddish-brown gravelly loam. Red when dry.
B	24 - 34" plus	Very compact red gravelly clay with some tint of purple. Red when dry.

Near the foot of the slope there is a similar profile with a harder B and shallower rooting.

The cotton rotation here runs about as follows:

(1) The forest is cleared and plantings made of rice, maize, peanuts, cassava and bananas, and squash.

(2) Maize followed by cotton.

(3) Maize followed by cotton. Near the end of the cotton cassava is planted.

(4) Wild fallow comes into the cassava after the first year.

for mulch. Some maize is grown with four months later planting, but, of course, it doesn't get off the land in time for cotton.

The surface of the ground is covered with red concretions. I look at the soil on a low knoll of about 3 percent slope, which might be considered an oromorphic associate of the one just described. The land has been cleared one year. The peanuts and maize are growing well, but not the rice. This is said to be a good soil for cotton.

Soil Profile Sample No. 7

A_1	0 - 1½"	Very dark reddish-brown to nearly black gravelly loam.
A_2	1½ - 6"	Reddish and grayish-brown gravelly loam. Purplish-red to red when dry.
A_3	6 - 24"	Reddish-brown gravelly loam. Red when dry.
B	24 - 34" plus	Very compact red gravelly clay with some tint of purple. Red when dry.

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K-1390 June 7, 1947 Belgian Congo
Bambesa. View of field devoted to rotation experiments on "Red Loam" soil, taken from high termite mound. Site of sample No. 6 in far background; and of No. 7 in right center. Note small young termite mound.

K-1391 June 4, 1947 Belgian Congo. Bambesa
Regeneration just beginning on "Red Loam" soil after 4 years of cropping ending with cassava and bananas. This is much better than simple fallow, which starts with weeds and grass, since the forest returns more rapidly. (Maize on another field in right background with normal second growth forest in far background.)

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(5) The rotation ends and forest grows for 10 years.

On the native farms a simpler rotation is followed with -

(1) Rice

(2) Peanuts or maize and cotton

(3) Cassava and bananas

(4) Back to forest for 12 or 13 years

I look at a cultivated soil similar to profile No. 6 in an open field. The profile is only 5 feet deep and I can see no gravel. There are some tiny nearly black concretions.

In these experiments a few soybeans are being grown on a trial basis.

There are several large old termite mounds, some medium-sized ones, and many small recent ones. Generally in this region the soil on the termite mounds is not so productive as the other soil; but sometimes it is a little more productive; and occasionally one side may be more productive and the other side less productive.

I look at this "Red Loam" soil after four years of cropping now going back to a grass fallow. Of course, this grass fallow is not so good as forest fallow. I take a sample here -- No. 8 -- of the A_1 horizon only, 0 - 4 inches, reddish-brown sandy clay loam. (Purplish-red to dark red when dry.)

In this profile and another I examine nearby, there are a great many insect holes made mostly by termites. I notice

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considerable charcoal and even relatively fresh grass in the soil down to 18 inches indicating that there must be a great deal of mixing brought about by these small animals. I also do not find any great change in the compaction of the soil with cropping as is the case at Yangambi. I see an excellent plot going back to forest fallow after cassava and bananas. This is much better than straight fallow where weeds and grasses come in first and delay the return of the forest. On the slopes here one may see some boulders of laterite scattered about.

I cross a small stream to another terrace and look at a profile in an old roadway. There is yellowish gravelly loam to 30 inches, then slightly pinkish-yellow gravelly loam over hardpan at 5 feet. Sample No. 9 is an example of this hardpan or cemented gravel, mottled yellow, pink, and brown.

A little farther on I examine a yellow soil on a very gently undulating terrace between two small streams. On one side the maize shows nitrogen starvation; on the other side, the cassava looks good.

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Soil Profile Sample No. 10

$A_{1(P)}$	0 - 3"	Mellow yellowish-brown sandy loam. Purplish-gray to reddish-brown when dry.
A_2	3 - 7"	Yellowish and grayish-brown sandy loam; easily friable to soft crumb. Light brown when dry.
A_3	7 - 15½"	Grayish-yellow friable heavy sandy loam. Light brown to pink when dry.
B_1	15½ - 31"	Grayish-yellow to yellow heavy sandy loam; only slightly compact. Reddish-yellow when dry.
B_2	31 - 42" plus	Yellow gravelly sandy clay loam. Light reddish-brown when dry. Broken gravel and small stones are red or orange-red. (Unfortunately this pit was not dug deeply enough.)

The soil is friable throughout and moist, but there are very few roots below 30 inches.

In the cultivated fields of maize and cassava, there are many large and small boulders of laterite on the surface.

I walk over to somewhat higher ground where the soil is browner. There are many boulders on the surface and a heavy solid fossil lateritic hardpan at 2 feet. Interestingly enough, the maize is better here. I take a sample of the lateritic hardpan as No. 11.

I go out onto an area of wet land that resembles our Portsmouth. The A_0 and A_1 are too shallow for the soil to be a real Half-Bog. The profile in this alluvial sand is as follows:

Soil Profile Sample No. 10

A_1(?)	0 - 3"	Yellow yellowish-brown sandy loam. Purplish-gray to reddish-brown when dry.
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I examine a profile at Bambesa. (Photo by Jurion.)

I examine a profile at Bambesa. (Photo by Burton.)

Soil Profile Sample No. 12

A_1	0 - 3"	Dark gray coarse sandy loam. Gray when dry.
A_3	3 - 14"	Slightly yellowish-gray heavy sandy loam. Light gray when dry.
G_1	14 - 30"	Light gray sticky clayey sand.
G_2	30 - 50" plus	Very light gray sticky clayey sand. Slightly mottled with yellow.

This soil has a good stand of cassava and bananas. It is said that one may get good crops here for only two or three years between forest fallows as compared to 4 or 6 with the red soil.

It seems that in this region the gravelly type of "Red Loam", described as No. 7, is the most common. Perhaps next would be the imperfectly drained sandy soil, No. 12, because there are so many little streams. The yellow lateritic soils are least common. They are not so good as the gravel-free "Red Loams", No. 6, but are thought to be better than the gravelly "Red Loams", No. 7. On the whole, the soils are said to be good in this region if not overcultivated; in fact, it is one of the best regions in the Congo.

This has been a very busy morning and now it is hot as we go to lunch.

After lunch we drive out to visit a native cooperative

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village with M. Knaff, an extension worker of great energy. On the way I see experimental plantings of rubber trees, but these are not very good. People here talk about man-made savanna as "anthropic savanna". If the fire is kept out, the forest will take over in four or five years. But the natives love to burn the savanna partly to scare out the game and partly just to see it burn.

The principles put into practice in this cooperative community involve the use of the corridor system to maintain the forest, avoid savanna, avoid fire, and maintain a productive soil through crop rotations and regeneration by forest. The destruction of soil structure by overcropping is thought by some to be more important than the loss of fertility. It seems to me that the two are so intimately related that it is impossible to tell which is more important, and it might not be of much matter if we could tell. Great care must be taken to induce the natives not to overcultivate for even one or two years extra, since that will encourage the savanna and greatly increase the length of the forest fallow.

The soils here are generally "Red Loams" of the gravelly type. The whole area of land used by the community is laid out in long corridors varying somewhat in length from community to community, depending upon soil conditions. These corridors are numbered 1 to 15 plus one additional for home sites. The community

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agrees on a general plan of rotation for the 15 corridors. Each family has a strip of its own, amounting to about 8 hectares, that cuts directly across all the corridors. Their homestead is on one end. Thus each family cultivates its own land and has complete responsibility for it and, of course, the produce. But all families follow the same general community rotation. (These natives here are strong individualists and like to work their land individually. Thus the type of cooperative developed here is unlike that described near Yangambi where the natives are traditionally more communal and prepare their corridors together.)

The first crop after cutting the forest is usually rice. The second year there is a food crop followed by cotton. Then in October, cassava and bananas may be interplanted both for food and for introducing the forest. Then the land goes back to forest.

The land of a great many old villages has been rearranged according to this general system. Of course, it is necessary to select areas that are suitable for farming. In many villages part of the land has been abused and is unsuitable now. The main road is arranged so that families can all be along the road and yet not too far from the center, which includes the chief's house, church, school, etc. But it is necessary to plan the agriculture first and then the various social and

Copy of diagram, showing progress of native cooperative
societies like the one visited near Barbosa

Road

One family holding

Homestead		corridor
Corridor	No. 1	(Forest)
Corridor	No. 2	(Forest)
Corridor	No. 3	(Rice)
Corridor	No. 4	(Forest)
Corridor	No. 5	(Forest)
Corridor	No. 6	(Clearing)
Corridor	No. 7	(Forest)
Corridor	No. 8	(Forest)
Corridor	No. 9	(Forest)
Corridor	No. 10	(Early food crops and cotton)
Corridor	No. 11	(Forest)
Corridor	No. 12	(Returning to forest)
Corridor	No. 13	(Forest)
Corridor	No. 14	(Cassava and banana)
Corridor	No. 15	(Forest)

Schematic outline of cooperative native village near Bambesa

Villagers agree on use of numbered, marked corridors, but each family works its own land. (Indicated rotation hypothetical possibility, with forest in different stages between regeneration and clearing.) In real plans boundaries often curved with soil boundaries.

K-1394 June 7, 1947
Belgian Congo. Near Bambesa. Typical native farm home in cooperative community.

K-1515 June 7, 1947
Belgian Congo. Bambesa. Farm house with farmer, his wife, and two of his four children.

K-1394

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K-1394 June 7, 1917
Belgian Congo. Near Bambesa. Typical native farm home in cooperative community.

K-1515 June 7, 1917
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K-1514 June 7, 1947
Belgian Congo. Bambesa. Kitchen hut of native farm.

K-1513 June 7, 1947
Belgian Congo. Bambesa. Natives extracting palm oil from nuts.

K-1514 June 7, 1917
Belgian Congo. Bambesa. Kitchen hut of native farm.

K-1513 June 7, 1917
Belgian Congo. Bambesa. Natives extracting palm oil from nuts.

medical services.

I go over one farm in some detail. The name of this farmer is Alipatengeme. He has one wife and four children. The house is about 30 feet long and perhaps 15 feet wide with a central hall and a men's room on one side and a women's room on the other side. This house is quite neat. In the men's room is a bed and a supply of cottonseed; in the women's room, a bed, table, some rice, a few utensils, and some spears. There is a loft for storage over the central hall. A thatched roof extends about 2 feet over the wall.

Back of the house is the kitchen house. Inside is a place for fire built among laterite stones. No hole is provided for the smoke so the inside is very sooty. I notice in the kitchen house some beds, fruit baskets, and a few small stools. This particular day, palm oil is being prepared from the nuts. They are stewed in a kettle resting on laterite stones and then crushed with a mortar and pestle.

I walk across the corridors and note that there is some variation from farm to farm. All of the corners are marked by special kinds of trees. The natives generally save their own seeds except the cotton seeds furnished by the ginnery.

The goats are a problem because they run wild to forage for their living and thus make it almost impossible to raise fruit. The natives never feed any of their animals. The chickens

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K-1392 June 7, 1947
Belgian Congo. Near Bambesa in native cooperative community on "Red Loam." View of corridor across several individual farms. Some maize and bananas, but mostly peanuts, to be followed by cotton in the second year of cultivation.

K-1393 June 7, 1947
Belgian Congo. Near Bambesa in native cooperative community on "Red Loam." M. F. Jurion, Director General of INÉAC in the Congo, by small termite mound near path across corridor of crops.

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Belgian Congo. Near Bambesa in native cooperative community on "Red Loam." M. F. Jurion, Director General of INEAC in the Congo, by small termite mound near path across corridor of crops.

feed on ants and garbage and what they can find in the fields.

After a brief visit to the laboratory where my soil samples are well laid out to dry, I return "chez" Lecomte just before sunset. This has been a hard day but I should have some good samples and pictures. I am much impressed with the great interest of the men in INÉAC with the native farmers. I have never seen such intense interest in any other large research organization that I know about. After a cool bath I sew on my field clothes. These won't last much longer. Just as it gets dusk I again hear the tom-toms in the distance. I can understand now how these drums might get on the nerves of lonesome people. Although the day has been hot the evening is almost cool.

As we sit on the porch talking before dinner, no one apparently pays any attention to the large and small insects that come in attracted by the gasoline lights. At dinner I am introduced to a new dish -- calderada, a Portuguese concoction with small fish. It wasn't intended for me.

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June 8: Bambesa to Gangala na Bodio

Last night it rained so we shall have muddy roads again. We leave Bambesa at 7:10 a.m. The "Red Loam" continues with gradually increasing man-made savanna. From Dembia to Bambili the soils are a complex of "Red Loam", gravelly "Red Loam", yellow soil, gray sandy alluvium, and an orange-red soil that we did not see at the station. There are many natives along the road. We pass a coffee plantation of about 300 hectares and many groves of oil palm for native use. Near Bambili there is a great deal of savanna from overcultivation. Here there is a coffee plantation and a large cotton purchasing center. We stop for a few minutes to wait for a ferry over the Bomokandi River. This time we send the car on ahead and M. Jurion and I cross rapidly in a native canoe.

At one time this area was even more populated, but with the coming of the savanna, the soils have deteriorated. I see people coming into market with pineapples and bananas.

There is only a narrow first bottom along this river and then we are again back on "Red Loam" with some patches of yellowish-brown soil. In many places there are lateritic boulders on the surface.

(There is one less dog in the Congo!)

After Boda, the land is gently rolling for a few kilometers, then undulating again. We gradually have more savanna.

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After Segute, we see very little forest except for the stream valleys, and the number of people is diminishing.

I try to get a picture of a baboon but I am afraid he is a little too fast for me.

A few kilometers west of Dili there are still many clumps of oil palm and good forest fallows with food crops. All along here I see a few old granite boulders. Just before reaching Dili I stop in a pure stand of cogongrass. The surface soil is a dark red friable clay loam underlain by red clay. At about 12 inches is a thin red gravelly clay over the hard lateritic hardpan beneath. Some call the cogongrass (Imperata) the number one enemy of the savanna. Once it gets well established, agriculture is practically hopeless. Here the crops near the road are poor. The soil has been exposed too much to the sun and is too unproductive for the regenerating forest.

Most of the natives along here wear simple loin cloths made from the bark of trees. As we drive along I see mostly men, many of them carrying spears. The huts are small, round, and have sharply conical thatched roofs.

Near Baranga the cover is mostly open savanna, 2 to 5 feet tall, except for gallery forests near the streams. (It's now quite hot again at 11 o'clock.)

I stop briefly near Gabu in the savanna. The hard lateritic hardpan is very near the surface -- in fact, exposed in

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K-1395 June 8, 1947
Belgian Congo. East of Dili. Overcropped soil with savanna of cogongrass (Imperata)-- the great enemy of productive soil in savanna.

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Belgian Congo. East of Dilli. Overcropped
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many places. We take a small sample of the hardpan and also of a small termite mound. The grasses are mainly cogongrass and pennisetum, with the latter where the soil is deeper. Now this lateritic hardpan seems to hold up the water. A little farther on the soil is deeper and there is some forest, but unfortunately I have no deep cuts in which to examine the soil.

Some 28 kilometers beyond Gabu the soil appears to be largely undulating "Red Loam" with deep, shallow, and gravelly types. Perhaps some 15 to 25 percent of the area is occupied by old and new termite mounds. I estimate that the cover may be 10 to 20 percent gallery forest and the rest savanna.

Beyond Kuma the soil is dark reddish-brown and somewhat gravelly, and has a lateritic hardpan. It seems to me that the savanna is probably growing as the natives overcultivate the forest galleries and these become narrower.

In this area beyond Dima the people belong to the Mangbetu tribe. They have long heads made by tying rope around the heads of the babies.

Beyond this area the country is better again. The soil seems to be about the same, but there is a higher proportion of forest.

Near Ganzi there is quite a bit of native oil palm in spots. The land has evidently been managed better and it supports a heavier population.

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Tapili still seems to be in the area of undulating "Red Loam". The cover is gallery forest along with broad areas of savanna and mixed savanna and forest. Near the town I see several fields cleared or being cleared for cotton planting.

About 25 kilometers beyond Tapili there are large areas of nearly open savanna again, with undulating to nearly level gravelly (concretionary) "Red Loam". About 20 kilometers west of Niangara the soil has a grayish-brown to yellowish-brown surface and a rather yellow subsoil. It is nearly level. We take a detour to the south from the main road in nearly open savanna on an imperfectly drained river terrace. In the higher places the soils are orange-red or red. We come to the Gada River and wait awhile for the ferry. The banks of the river are yellowish sandy alluvium some 12 feet deep. We then go on to Niangara on dull reddish-brown soil of the river terrace. It is very hot here.

Leaving Niangara we pass through nearly open savanna with a few galleries. The land has a little more relief and the soil is more red. Food crops are grown in spots. Here, and elsewhere today, I see mango trees along the road. As we go southeast, the soil gradually becomes redder.

This is the area of the Azande tribe. The chief is 78 years old and knew Stanley personally. He is said to have 120

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wives, is the first to sleep with his own daughters, and also sleeps with his daughters-in-law when he visits his sons. Even now he has several new babies.

After we pass Makilimbo the soil is undulating to nearly level gravelly "Red Loam", covered with savanna and a few scattered small trees except for a very few galleries. The population is relatively small and is mostly on the edge of the forest. As the natives overcultivate and the savanna grows, the people move farther and farther into the forest. In places the lateritic hardpan is quite near the surface.

Fourteen kilometers beyond, the soil has more relief but is still gravelly "Red Loam". There are said to be many elephants in this general region. After we pass Dange there is somewhat better vegetation for a little ways and the soil is gently undulating. Just before reaching Ekibondo there is more forest, more people, more oil palm, and more food crops. Just west of Dungu the lateritic hardpan is again near the surface in several places. Some of the soil is yellowish-brown on the surface. Part of this yellowish-brown soil is in savanna, part is in forest, and part is used for food crops.

There is a nice modern bridge over the Kibali River at Dungu. An old fortress here has been rebuilt for Government buildings. The resulting architecture is not very pleasing.

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forested and the savanna we see here now is anthropic -- man-made. If only the fires could be kept out, the forest could establish itself and the soil be productive for food crops again.

East of Dungu for a little ways, there is yellowish-brown soil on a smooth river terrace. Then we pass to a gently rolling country of nearly open savanna with some food crops and a few trees. For a little ways the soil is a patchwork of yellowish-brown, purplish-brown, and ocher yellow. Then we are into a broad area of "Red Loam" with only a small proportion of the other soils. In the lower places the soils have a dark grayish-brown surface over yellowish-gray with dense savanna. In some places there is lateritic hardpan near the surface and in these the vegetation is thinner.

There are few people along the road because the population is widely scattered in the bush.

Thirty-seven kilometers east of Dungu I look at the soil and take a sample in the nearly level imperfectly drained savanna. The main grasses are 3 to 4 feet high. These would get somewhat higher without burning. The principal species include Andropogan (sp) and Hyparrhenia (sp).

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Soil Profile Sample No. 13

A_{10}	0 - 5"	Dark brown very fine sandy loam. Dense roots. (To purplish-gray when dry.)
A_{11}	5 - 12"	Dark brown, with tinge of red, somewhat compact fine sandy loam. Some roots. Dark reddish-brown when dry.
B_1	12 - 20"	Dark brown, with tinge of purple, gravelly loam. Compact. Reddish-brown when dry.
B_2	20 - 40"	Yellowish-brown very compact gravelly loam. Reddish-brown to reddish-yellow when dry.
B_{30}	40 - 54"	Transitional. Fairly compact. Reddish-yellow and yellowish-red when dry.
B_{31}	54 - 64"	Mottled red and yellow gravelly clay. Red and reddish-yellow when dry.
C	64 - 80" plus	Red gravelly clay. Digs out easily.

There are very few roots below 18 inches. Whether or not the vegetation here is true natural savanna isn't known. At least the savanna has been here for a very long time. At greater depth than we can go there may be hard laterite. The land is poor for crops. This profile might make an interesting comparison with samples Nos. 6 and 7 under the forest.

A few kilometers farther east we pass over very red soil with many lateritic boulders used in the roadside fences. Apparently these were removed from the ditches in making the road.

We turn off the main road and take a short cut to Gangala na Bodio./a

/a This is the headquarters of the Elephant Training Station, M. Haezaert, Director, and the temporary headquarters for the adjoining National Park, M. Harroy, Temporary Director.

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Table 9. Analyses of imperfectly drained associate of Earthy Red Latosol. (13)

Sample No.	Horizon	Depth	pH	Organic ~~Matter~~ Carbon	Size Class and Diameter of Particles (*in mm.*)							Other Classes (*in mm.*)		
					Very coarse sand 2–1	Coarse sand, 1–0.5	Medium sand, 0.5–0.25	Fine sand, 0.25–0.1	Very fine sand, 0.1–0.05	Silt, 0.05–0.002	Clay, <0.002	0.02–0.002	<0.005	>2
		Inches		*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
48676	A_{10}	0–5	5.0	1.8	6.1	6.7	7.4	23.7	14.8	22.7	18.6	8.0	20.2	6
677	A_{11}	5–12	4.7	1.6	5.8	6.1	7.1	22.2	11.9	25.6	21.3	7.8	22.5	1
678	B_1	12–20	5.0	1.4	11.7	5.6	5.8	20.6	13.0	20.1	23.2	6.9	24.1	60
679	B_2	20–40	4.8	0.8	20.3	8.1	5.3	13.6	7.7	20.9	24.1	6.5	25.3	56
680	B_{30}	40–54	4.8	0.7	10.4	7.2	4.7	13.2	10.6	17.8	36.1	6.5	37.3	68
681	B_{31}	54–64	5.0	0.5	12.4	9.1	4.8	10.3	7.0	22.6	33.8	7.5	35.8	53
682	C	64–80+	5.1	0.3	10.9	9.2	4.0	9.7	10.3	22.7	33.2	10.1	35.4	17

			Exchangeable Cations me/100 g					Sum of Cations me/100 g	% Base Saturation
			Ca	Mg	Mn	K	H		
48676	A_{10}	0–5	1.2	1.3	0.03	0.5	8.9	11.9	25
677	A_{11}	5–12	0.8	0.4	0.02	0.4	10.1	11.7	14
678	B_1	12–20	0.7	0.1	0.01	0.6	10.0	11.4	12
679	B_2	20–40	0.4	<0.1	<0.01	0.5	7.8	8.7	10
680	B_{30}	40–54	0.8	0.3	<0.01	0.9	8.7	10.7	19
681	B_{31}	54–64	1.0	0.1	<0.01	0.6	7.5	9.2	18
682	C	64–80+	1.3	0.3	<0.01	0.5	6.7	8.8	24

Congo Soil Profile No. 13

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Congo Soil Profile No. 15

Horizon	Depth inches	pH	Exchangeable cations m.e./100 g. Ca	Mg	K	Na	Organic matter	Very coarse sand 2-1 mm.	Coarse sand 1-0.5 mm.	Medium sand 0.5-0.25 mm.	Fine sand 0.25-0.1 mm.	Very fine sand 0.1-0.05 mm.	Silt 0.05-0.005 mm.	Clay 0.005 mm.	Fine clay 0.005 mm.	Moisture equivalent %	Saturation %
A1	0-3	5.0	1.8	0.3	0.1	0.0	1.8	6.1	7.7	14.4	25.7	14.8	22.7	18.6	30.3	6.0	38
A2	3-12	4.7	0.4	0.2	0.0	0.0	1.5	8.2	6.2	7.1	10.6	7.3	38.6	21.2	44.3	4.3	25
B1	12-30	4.8	0.8	0.2	0.0	0.0	0.7	4.0	3.2	4.8	12.2	10.8	20.3	39.2	52.3	7.9	39
B2	30-42	4.8	0.4	0.2	0.0	0.0	0.4	1.0	1.8	4.7	10.1	12.6	17.8	42.1	52.8	7.6	36
B3	42-54	4.8	0.2	0.2	0.0	0.0	0.3	1.0	1.8	4.7	10.1	12.6	17.8	42.1	52.8	7.6	36
C	54+	5.0	1.2	0.2	0.0	0.0	0.2	1.0	1.8	4.7	10.1	12.6	17.8	42.1	52.8	7.6	36

Some Characteristics of Parent Material (in mm.)

Horizon	Depth inches	Organic matter	Coarse fragments >2	Other Classes (in mm.) 2-0.05	0.05-0.005	<0.005
A1	0-3	1.8	6.0	30.3	20.3	49.4
A2	3-12	0.8	7.9	24.1	38.6	37.3
B1	12-30	0.4	5.5	22.3	39.2	38.5
B2	30-42	0.3	5.5	22.3	42.1	35.6
B3	42-54	0.2	7.5	22.3	42.1	35.6
C	54+	0.2	10.1	22.3	42.1	35.6

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Immediately we are on dark brown soil over yellow soil like that on the river terrace at Dungu. The vegetation is savanna with scattered savanna trees. We reach the station at 6:20 p.m. and have dinner with M. and Mme. Harroy and M. Haezaert. While at dinner we hear a lion roar from over the river in the wild savanna.

There is some talk at dinner about the danger of erosion and increasing desert in the Belgian Congo. Harroy has written a highly emotional book, Afrique terre qui meurt, which I haven't read, but which I have heard about. He has accepted at face value the most extreme statements about erosion and spreading deserts in south Africa and north Africa and warns the public (he says especially the Administrators in Brussels) of the danger of these twin evils ruining the Belgian Congo. The conversation is very friendly but I am sure I will be unable to agree with his thesis, to say nothing of the unscientific, almost anti-scientific, treatment I suspect he gives his subject. He promises to send me a copy of the book. Certainly overcultivation and the burning of the savanna have resulted in decreased soil productivity. But so far, I've seen no significant accelerated erosion.

I go to bed by lantern light in a little cabin by the river. Very tired.

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K-1396 June 9, 1947
Belgian Congo. Gangala na Bodio. Rather mean elephant -- Baoli -- at elephant training station, caught in 1927 and now about 30 years old.

K-1397 June 9, 1947
Belgian Congo. Gangala na Bodio. View of savanna looking east over the Dungu River.

K-1396 June 9, 1947
Belgian Congo. Gangala na Bodio. Father Mean elephant -- Baoli -- at elephant training station, caught in 1927 and now about 30 years old.

K-1397 June 9, 1947
Belgian Congo. Gangala na Bodio. View of savanna looking east over the Dungu River.

Captive young giraffes at Gangala na Bodio.
(Photos by Jurion.)

Elephants of the training station at early bath.
Gangala na Bodio. (Photos by Jurion.)

Captive young giraffes at Gangala na Bodio.
(Photos by Burton.)

Elephants of the training station at early bath.
Gangala na Bodio. (Photos by Burton.)

June 9: Gangala na Bodio to Mount Hawa

We are up early in the morning to see the elephants. Most of them are captured while they are small and trained to obey commands and pull loads. Just as I get a picture of the oldest and meanest one, the director warns me that I am too close. He hurt one of the native boys badly a few days before. Each elephant is trained by one native. After seeing the elephants watered we look at some small captive giraffe and a little chimpanzee.

After breakfast with M. Haezaert, I look at the yellow soil on the nearly level river terrace under typical savanna. The pit is made too near the road and not so deep as I should like.

Soil Profile Sample No. 14

$A_{1(P)}$	0 - 7"	Very dark gray silty clay; firm, but easily friable to rubbery granular; many roots. Dark gray when dry.
A_3	7 - 13"	Dark brown silty clay loam; firm, but easily friable to crumb; porous. Purplish-gray when dry.
B_1	13 - 22"	Brown very fine sandy clay loam; firm but friable; many roots. Light reddish-brown when dry.
B_3	22 - 32"	Yellowish-brown, firm, but easily friable very fine sandy clay loam, mottled with yellow and orange-red. Brownish-yellow when dry.
C_1	32 - 44"	Similar to above but somewhat lighter in color. Yellow when dry.
C_C	44 - 46" plus	Lateritic hardpan. Reticulate mottling of black, orange-red, and yellow. Quite hard. This lateritic hardpan is about 2 to 3 feet thick. I rather doubt that it has much relationship to the present solum.

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Table 10. Analyses of imperfectly drained associate of Earthy Red Latosol. (14)

Sample No.	Horizon	Depth	pH	Organic ~~Matter~~ Carbon	Size Class and Diameter of Particles (*in mm.*)							Other Classes (*in mm.*)		
					Very coarse sand 2–1	Coarse sand, 1–0.5	Medium sand, 0.5–0.25	Fine sand, 0.25–0.1	Very fine sand, 0.1–0.05	Silt, 0.05–0.002	Clay, <0.002	0.02–0.002	<0.005	>2
		Inches		*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
48683	$A_1(p)$	0–7	5.3	3.3	0.4	4.6	5.9	17.0	9.5	19.0	43.6	14.8	49.0	0
684	A_3	7–13	4.6	1.9	0.6	4.8	6.0	16.3	8.1	15.5	48.7	10.8	52.6	0
685	B_1	13–22	4.2	1.1	0.4	4.8	6.3	17.0	7.2	13.9	50.4	9.3	53.4	0
686	B_3	22–32	4.5	0.7	0.8	3.9	5.0	15.3	7.3	11.9	55.8	7.5	58.3	0
687	C_1	32–44	4.4	0.7	0.7	3.8	4.2	12.9	7.0	12.4	59.0	7.7	61.8	0

Sample No.	Horizon	Depth	Exchangeable Cations me/100 g					Sum of Cations me/100 g	% Base Saturation	Thermal Analysis Data Minerals Present	
			Ca	Mg	Mn	K	H			Particle Size Analyzed	Kaolinite ~~Type~~ %
48683	$A_1(p)$	0–7	5.5	2.4	0.10	0.9	14.8	23.7	38		
684	A_3	7–13	1.5	0.9	0.05	0.4	16.0	18.8	15	<2μ	55
685	B_1	13–22	1.0	0.5	0.04	0.3	14.0	15.8	12	<2μ	55
686	B_3	22–32	0.8	0.4	0.06	0.4	11.2	12.9	13		
687	C_1	32–44	0.8	0.5	0.08	0.5	10.7	12.6	15	<2μ	55

Congo Soil Profile No. 14

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Congo Soil Profile No. 14

Sample No.	Horizon	Depth inches	pH	Organic Carbon pct.	Very coarse sand 2-1 pct.	Coarse sand 1-0.5 pct.	Medium sand 0.5-0.25 pct.	Fine sand 0.25-0.1 pct.	Very fine sand 0.1-0.05 pct.	Silt 0.05-0.002 pct.	Clay <0.002 pct.	0.002-0.005 pct.	<0.005 pct.	Pct. <2
4888	A1	0-7	5.3	3.3	0.4	4.6	8.9	17.0	9.3	19.0	45.6	14.8	49.0	0
889	A3	7-15	4.6	2.3	0.6	4.8	6.0	15.2	9.1	15.2	48.7	10.8	53.4	0
890	B1	15-55	4.3	1.1	0.4	3.9	2.2	7.3	4.3	11.3	30.4	3.3	33.4	0
891	B2	55-72	4.4	0.7	0.4	2.8	0.9	2.3	0.7	12.4	8.8	7.7	8.8	0
892	C1	72+	4.3	0.3	0.4	2.8	0.9	2.3	0.7	12.4	8.8	7.7	8.8	0
893	A1	0-7	5.3	4.3	0.2	4.0	8.8	14.8	8.2	18.4	41.3	14.8	46.0	0
894	A3	7-15	4.5	2.3	0.2	3.0	4.0	11.5	6.0	15.8	32.0	10.8	35.4	0
895	B1	15-55	4.3	1.1	0.2	3.0	2.2	7.3	4.3	11.3	30.4	3.3	33.4	0
896	B2	55-72	4.4	0.7	0.2	2.8	0.9	2.3	0.7	12.4	8.8	7.7	8.8	0
897	C1	72+	4.3	0.3	0.2	2.8	0.9	2.3	0.7	12.4	8.8	7.7	8.8	0

(a) Thermal Pleistocene Data

(b) Thermal Pleistocene Data

Size Classes and Diameter of Particles (in mm.)

Other Classes (in mm.)

Mechanical analysis data
Sum of Centrifuge Base Saturation
Partial Base Saturation
Unleached Residue
me/100 g
me/100 g

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During nine months of the year this soil is quite wet. Offhand, I would say it belongs somewhere between tropical Wiesenboden and Ground-Water Laterite.

We leave at about 10 a.m. On the main road at Wanda we are back on "Red Loam" with nearly open savanna. In the lower places the soil has a dark brown surface. These are probably moist a good deal of the time. After a few kilometers the soil is very dark in the surface 18 inches and then intensely red for the next two feet, gradually becoming somewhat lighter red with depth. Along here I see some swamps with papyrus -- the plant formerly used by the Egyptians for paper. About 40 kilometers down the road I see a good deal of soil similar to samples Nos. 13 and 14.

The people here belong to the Azande tribe (with the prolific chief). There is only a little farming in this savanna country, partly because the area is far from transportation. Coffee has been tried without much success. Silkworms are a real possibility with more research. There is not much to be seen besides food crops.

At Faradje a Catholic Mission has black sisters. They go barefoot and keep to their native tongue. They teach the other native girls. Near the town I see some good citrus and good mangoes. There are good food crops here, including maize, sweet potatoes, cassava, bananas, squash, etc. I see good

During nine months of the year this soil is quite wet. Offhand, I would say it belongs somewhere between tropical Wiesenboden and Ground-Water Laterite.

We leave at about 10 a.m. On the main road at Wanda we are back on "Red Loam" with nearly open savanna. In the lower places the soil has a dark brown surface. These are probably moist a good deal of the time. After a few kilometers the soil is very dark in the surface 18 inches and then intensely red for the next two feet, gradually becoming somewhat lighter red with depth. Along here I see some swampa with papyrus -- the plant formerly used by the Egyptians for paper. About 40 kilometers down the road I see a good deal of soil similar to samples Nos. 13 and 14.

The people here belong to the Azande tribe (with the prolific chief). There is only a little farming in this savanna country, partly because the area is far from transportation. Coffee has been tried without much success. Silkworms are a real possibility with more research. There is not much to be seen besides food crops.

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citrus on the characteristic "Red Loam". Beyond Faradje we enter the area of the Logo tribe. Most of the people wear very little beyond a small piece in front and little bundle of bush behind.

Just beyond Faradje I examine a deep cut in the gravelly "Red Loam". Down as far as 7 feet there is no lateritic hardpan.

$A_{1(P)}$	0 - 8"	Dark red gravelly (concretionary) clay loam.
A_3	8 - 50"	Slightly yellowish-red gravelly clay. The pick leaves orange-yellowish streaks. The material is quite friable.
B(?)	50 - 72" plus	Dark orange-red gravelly clay with some mottling of yellow and red. There are some coarse angular fragments along with imbedded concretions.

From this cut, I take a sample from a well-weathered quartz vein. Probably the soil consists of one-half to two-thirds concretions. These are orange-red when broken. There are insect holes down to 50 inches. Excellent citrus and mangoes are growing on this site.

The natives here use a straight hoe mounted on a long pole for killing weeds with very shallow cultivation.

After 3 or 4 kilometers the soil is again much like No. 13. There is fairly open savanna having a rather thick stand of low trees in places. Near Aywa I see some excellent maize for this area. It might yield 25 to 30 bushels per acre. Most of the yields are much less than this. The natives use the maize for food and for making beer.

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West of Aba the soil is nearly level and imperfectly drained. It seems to be quite good for maize. Some grain sorghums and other grains are grown too. Eleusine will be planted soon. Here the natives cultivate for about two years and then the land goes into savanna fallow for 10 to 12 years. There is also quite a bit of cassava grown here. Near Aba I see a good planting of robusta coffee under partial shade. This plantation also has some Montana tung. The natives are harvesting citronella for distillation.

Sixty kilometers east of Faradje granite peaks come into view. The soil has more relief and an orange-red color in depth below the reddish-brown surface. We stop at Aba for lunch and need to wait until 2 p.m. for the gasoline station to open. The soil is gently rolling, dark brown in the surface and orange-yellow beneath.

Beyond Aba we are again on "Red Loam" with concretions. I see quite a bit of land that has been cleared for pasture but ranching was unsuccessful because of sleeping sickness. There is a good deal of maize and some coffee under partial shade. We go on south over nearly level soil with a dark surface something like sample No. 13. The savanna has many small trees. In burning this area for cultivation good farmers pile the brush away from the stumps so that these will live over for regeneration after cultivation.

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Twenty kilometers south of Aba the soil is like No. 13 with a few easily crushed quartzite fragments of cobble size. The rain this morning has made the road here very muddy in places. There is an increasing amount of grain sorghum. Many of the plants are very slender and 7 to 9 feet tall.

The first bottoms along the streams have a nearly black surface of 12 to 24 inches underlain by gray and medium-gray soil. Along here the vegetation is very dense -- tall savanna with a few trees.

At 40 kilometers we approach closely a range of granite knob hills, mostly steep and nearly barren.

At about 45 kilometers south of Aba I stop to examine the soil from the granite. This soil is on a rather strong slope. It is only 5 to 7 percent where the profile is taken and about 26 percent just above it. The elevation is around 1,000 meters.

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Soil Profile Sample No. 15

A_1	0 - 11"	Black friable heavy very fine sandy loam. Porous from ants, worms, and other animals. Gray to dark gray when dry.
A_{30}	11 - 15"	Transitional. (Not sampled)
A_{31}	15 - 30"	Dark brown sticky coarse sandy clay. Reddish-brown when dry.
B_1	30 - 38"	Dull reddish-brown gravelly clay. (Not sampled)
B_2	38 - 62"	(Sample taken between 45 and 48). Reddish-brown gravelly clay. Sticky. Not very firm. Mottled a little. Yellowish-red when dry.
B_{30}	62 - 66"	Transitional. (Not sampled)
B_{31}	66 - 80"	Dull brown micaceous clay loam. Softly mottled with yellow, brown, and orange. Reddish-yellow when dry.
C	80 - 95" plus	Rather strongly mottled rotten granite. The material in place retains the shape of the rock outlines. Reddish-yellow when dry.
D		Not to be found at 95 inches. I get a sample nearby. There are a few fragments of the D throughout the solum.

Likely there has been some soil movement in the upper part of this profile but there are clear relicts of old rocks in the B_{31}. The A_1 is very loose when dry. At another place I notice that the A_1 is about 13 inches.

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Table 19. Analyses of Black-Red Latosol. (15)

Sample No.	Horizon	Depth	pH	Organic ~~Matter~~ Carbon	Size Class and Diameter of Particles (*in mm.*)							Other Classes (*in mm.*)		
					Very course sand 2–1	Coarse sand, 1–0.5	Medium sand, 0.5–0.25	Fine sand, 0.25–0.1	Very fine sand, 0.1–0.05	Silt, 0.05–0.002	Clay, <0.002	0.02–0.002	<0.005	>2
		Inches		*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
48690	A_1	0–11	5.7	2.3	6.3	11.8	9.5	19.4	11.0	16.0	26.0	8.7	28.4	5
691	A_{31}	15–30	5.9	0.7	17.0	14.2	8.1	13.2	7.4	10.7	29.4	5.6	30.4	4
692	B_2	38–62	6.0	0.2	25.0	12.4	4.9	8.7	5.9	10.3	32.8	6.8	35.7	36
693	B_{31}	66–80	5.5	0.2	5.1	10.4	6.9	14.0	7.6	22.4	33.6	17.7	39.4	7
694	C	80–95	5.3	0.2	2.6	11.8	9.3	21.7	11.4	18.3	24.9	11.7	28.0	<0.5

Sample No.	Horizon	Depth	Exchangeable Cations me/100 g					Sum of Cations me/100 g	% Base Saturation	Total P	Available P
			Ca	Mg	Mn	K	H			%	p.p.m.
48690	A_1	0–11	6.9	1.9	0.11	0.6	8.8	18.3	52	.039	5
691	A_{31}	15–30	3.2	1.6	0.09	0.6	4.9	10.4	53	.025	3
692	B_2	38–62	2.7	1.8	0.02	0.4	3.9	8.8	56	.015	4
693	B_{31}	66–80	4.7	2.3	0.01	0.3	5.1	12.4	59		
694	C	80–95	4.2	1.8	0.02	0.3	5.5	11.8	54	.021	3

Congo Soil Profile No. 15

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Congo Soil Profile No. 15.

Sample No.	Horizon	Depth	pH	Organic matter	Very coarse sand 2-1	Coarse sand 1-0.5	Medium sand 0.5-0.25	Fine sand 0.25-0.1	Very fine sand 0.1-0.05	Silt 0.05-0.002	Clay <0.002	Other Classes (in mm.) 0.02-0.002	<0.002	>2
			Ce	Ne	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
48390	A1	0-11	5.1	2.3	2.3	11.8	3.5	13.4	11.0	16.0	26.0	8.1	28.4	5
esl	A3	15-30	6.0	0.0	17.0	14.5	8.1	8.7	7.4	10.7	26.4	6.8	30.4	4
ess	B21	38-58	5.2	0.0	25.0	12.1	4.9	7.0	3.9	10.2	23.8	17.7	35.7	3
esm	B22	68-80	5.2	0.0	2.8	10.4	5.9	24.0	7.6	22.4	23.4	11.7	23.4	4
esn	C	80-95	5.2	0.0	2.8	11.8	2.3	21.4	11.4	18.3	24.3	7.2	28.0	4

Sum of Ostiona Bases per 100 g Saturation

Ca	Mg	K	Na	H	me/100 g Saturation
6.4	1.1	0.0	0.0	12.3	19.8
6.0	0.6	0.0	0.0	10.4	17.0
5.2	1.5	0.0	0.0	8.8	15.5
4.4	1.5	0.0	0.0	12.8	18.7

Total Available p.p.m.

P	K	Mn	Fe
5	39	4.0	230.
3	52	4.0	250.
3	39	4.0	230.
3	39	4.0	230.

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This doesn't appear to be a very good soil for crops, and the present cover is savanna with low trees. There are a few gently sloping soils on these granite ridges, but most of them are rolling to steep with the upper slopes bare. The soil on the gentle slopes is now quite moist. In these moist places the A_1 may be a trifle deeper, but otherwise the soil is similar. One sees only a few natives. Crops of maize, grain sorghum, and cassava are not so good as on the "Red Loam" but still not too bad. I wonder why there are few, if any, termite mounds on this soil.

A little farther on I see a similar black soil with a more distinctly red and heavier B from a more finely grained and more basic granite on a long colluvial slope. One would need a long time to study the geomorphology here in order to establish the genesis of the soils.

Shortly after crossing the Zoro River, some 65 kilometers south of Aba, the granite appears to be under older material in most places. The soil is very dark brown and similar to that near Aba but not quite so red. After this transitional area, we drive over red soil again with termite mounds not so big as in the forest. We continue on undulating land under savanna with savanna trees thick in places. Most of the soils are very dark brown to nearly black in the surface 6 to 18 inches. Are these perhaps a tropical red Prairie soil?

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Here the natives carry bows and arrows mostly; only a few have spears.

One hundred kilometers south of Aba we enter the area of the Lugware tribe. Until just a few years ago,these people wore no clothing at all. Even now the women wear very little. Many have only a tiny spray of leaves in front and another behind, held by a cord above the hips. But the men wear more clothes, probably following the example of the Europeans they see along the road.

As we drive on there are areas with strongly red, orange-red, dark grayish-brown, and yellowish-brown soil underneath a variable dark surface soil. Here and there granite knobs can be seen again in the plain north of Aru. In a few places there is some more soil developed from granite. At 110 kilometers south of Abu there is more open grass land on the undulating plain. Here some native small Zebu cattle are raised. The grass is about 1 to 2 feet high now. The surface soil is a dark gray and is underlain by grayish- or yellowish-brown subsoil. This landscape reminds me a little of the high grazing lands of northern Arizona. One sees a few patches of grain sorghum, cassava, and other food crops, but cultivation is mostly in the valleys near the water. I see only low small termite mounds.

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About 20 kilometers north of Aru there is quite a bit of cassava, but here it is only about 30 inches high in contrast to that at Bambesa which is nearly 10 feet high.

Now at 5:35 the sun is ready to set and there is very little twilight in this country. It is a great pity we must hurry on, but there are still some 20 miles to go yet.

A little north of Aru I see a large set of buildings where silkworm cacoons are bought and dried. These are grown in this region. Most of them are grown rather far from the road in order to avoid the dust.

Beginning 18 kilometers north of Aru on a winding road, the soil becomes quite red again but is still covered by open grass land with grasses only 20 to 30 inches high along with a few shrubs and low trees. I regard this as probably typical "Red Loam" under savanna.

We pass fairly close to two villages. These are made up of a patch of mulberry trees, then a straight row of buildings for silkworms, then the round huts for the natives, then a row of planted Eucalyptus trees, and finally a patch of maize and other food crops on the opposite side.

We reach Aru at 6 o'clock. In the village there are many nice Eucalyptus trees, mangoes, and fair citrus. It seems like quite a nice little town. It is the local Government headquarters something like one of our county seats. We drive

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on to the silkworm station of INEAC at Mount Hawa. It will soon be too dark to write. Night comes here with a bang. As we go along I see a few fires in the savanna, perhaps partly for clearing and partly for sport. As we pass one of the villages I notice that the huts are made mostly of adobe bricks. They are round and thatched with conical roofs.

(This afternoon we saw fewer chickens and many less goats in the road.)

The land is strongly undulating to gently rolling and I can see low hills to the south, but it will be dark before we reach them. No more field work today.

We arrive at Mount Hawa station at 6:30 p.m. and meet M. Couvreur, the acting superintendent. Unfortunately, there is a little confusion over our quarters. There was some question as to whether we might reach here tonight and a district commissioner and an assistant have been put in the places we were to have. But Director Jurion soon explains that they must leave.

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June 10: Mount Hawa to Nioka[a]

Before breakfast I go out and examine a truncated fossil laterite on a small hill at the station. Probably the original parent material is granite but one can't be certain. This hill has been eroded and the lateritic hardpan exposed. Now there is a savanna cover and a few small shrubs.

Soil Profile Sample No. 16

A_1	0 - 1"(0-2")[b]	Dark reddish-brown gravelly loam resting directly on lateritic hardpan. In places absent, and in pockets 2 inches thick. Reddish-brown when dry.
C_C	1 - 45"	Mottled red, orange, and yellow hard laterite. (The sample is split into two parts -- C_{C-1}, the upper, and C_{C-2}, the lower.)
C_1	45 - 60"	Red gravelly clay
C_2	60 - 82"	Fairly friable red clay
C_3	82 - 110" plus	Red fine sandy clay mottled with yellow and white.

Of course the material sampled may be colluvial, but I doubt it. Certainly it has been in place for many centuries.

---

[a] Elevation about 4,920 feet; rainfall 46.8 inches.

[b] Numbers in parentheses refer to limits of horizons varying significantly in thickness.

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Table 22. Analyses of Lithosol from laterite. (16)

Sample No.	Horizon	Depth	pH	Organic ~~Matter~~ Carbon	Size Class and Diameter of Particles (*in mm.*)							Other Classes (*in mm.*)		
					Very coarse sand 2–1	Coarse sand, 1–0.5	Medium sand, 0.5–0.25	Fine sand, 0.25–0.1	Very fine sand, 0.1–0.05	Silt, 0.05–0.002	Clay, <0.002	0.02–0.002	<0.005	>2
		Inches		*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
48696	A_1	0-1	5.3	3.7	2.8	5.8	5.6	18.9	14.0	13.7	39.2	8.0	42.2	28
699	C_1^1	45-60	4.9	0.2	19.2	12.1	4.4	7.8	5.7	9.0	41.8	5.8	44.0	10
700	C_2^1	60-82	4.9	0.1	1.2	2.4	2.5	13.2	14.8	24.2	41.7	17.5	47.8	0
701	C_3^2	82-110+	5.3	<0.1	1.0	3.1	3.8	16.7	16.1	26.2	33.1	18.9	39.3	0

			Exchangeable Cations me/100 g					Sum of Cations me/100 g	% Base Saturation
			Ca	Mg	Mn	K	H		
48696	A_1	0-1	1.8	1.1	0.09	0.5	12.9	16.4	21
699	C_1^1	45-60	0.2	0.4	0.01	0.6	5.5	6.7	18
700	C_2^1	60-82	0.2	0.3	0.02	0.5	4.2	5.2	20
701	C_3^2	82-110+	0.1	0.2	0.01	0.3	4.5	5.1	12

Congo Soil Profile No. 16

U. S. GOVERNMENT PRINTING OFFICE 16—46512-2

Sum of Exchangeable Cations me/100 g

% Saturation

Size Classes and Diameter of Particles (in mm.)

Other Classes (in mm.)

Sample No.	Horizon	Depth in inches	pH	Organic Carbon	Very coarse sand 2-1	Coarse sand 1-0.5	Medium sand 0.5-0.25	Fine sand 0.25-0.1	Very fine sand 0.1-0.05	Silt 0.05-0.002	Clay <0.002	0.02-0.002	<0.005	>2
				Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
45685	A1	0-7	5.3	3.7	2.8	5.8	5.6	18.3	14.0	12.7	39.3	8.0	42.3	28
686	C1	7-30	4.9	0.3	1.5	12.1	4.4	5.7	5.7	8.0	44.8	5.8	44.0	10
687	C2	30-85	4.3	0.1	1.5	3.4	2.5	12.3	14.8	24.2	41.7	12.5	47.8	0
688	C3	85-110+	5.2	0.1	1.0	3.1	2.8	15.7	15.7	26.5	35.1	18.3	39.3	0

Sample No.	Horizon	Depth in inches	pH	Ca	Mg	K	H	Ca	Mg	K	H
				me/100 g				%			
45685	A1	0-7	5.3	1.8	1.1	0.09	12.3	12.4	7.7	0.6	79.3
686	C1	7-30	4.9	0.5	0.4	0.01	5.3	7.8	6.7	0.2	85.3
687	C2	30-85	4.3	0.1	0.3	0.03	4.3	2.5	5.2	0.5	91.8
688	C3	85-110+	5.2	0.1	0.3	0.01	3.2	3.1	7.1	0.3	89.5

Cuyo Soil Profile No. 16

K-1398 June 10, 1947
Belgian Congo. Mount Hawa. View of cut in truncated fossil laterite. (Site of sample No.16.)

K-1398 June 10, 1947
Belgian Congo. Mount Hawa. View of cut in truncated fossil laterite. (Site of sample No.16.)

I go to see the spinning of the silk from the cacoons in a nearby building. Each of these cacoons has only one thread and this is about 1 kilometer in length. I am given some samples of the raw silk.

After seeing the spinning I go to a welcome breakfast. I am told that with present prices in this area it costs 10 head of cattle for one wife. I should say here it is the "first cost" rather than the "upkeep". The wife works the fields, looks after the house, and gathers the firewood. With a pair of pruning shears, she may get a nice new dress anytime! Many of those who work for the station use the money they earn to buy cattle for a wife. The social prestige associated with cattle ownership is unfortunate since the available ranges are already crowded, and an increase will bring erosion.

After breakfast I look at another deep cut with mixed local alluvium in the surface 18 to 24 inches. This is underlain by dark red fine gravelly clay, characteristic of concretionary "Red Loam", about 1 to 2 feet thick. Beneath this is a layer of variable thickness of rather soft, slightly purplish, red very friable fine sandy clay. At about 6 feet or more, this grades into pinkish-white material with spots very high in kaolin and containing old veins of quartz. Both roots and ants penetrate deeply. Clearly the material is residual below about 2 feet but the mother rock is uncertain.

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After seeing the spinning I go to a welcome breakfast. I am told that with present prices in this area it costs 10 head of cattle for one wife. I should say here it is the "first cost" rather than the "upkeep". The wife works the fields, looks after the house, and gathers the firewood. With a pair of pruning shears, she may get a nice new dress anytime! Many of those who work for the station use the money they earn to buy cattle for a wife. The social prestige associated with cattle ownership is unfortunate since the available ranges are already crowded, and an increase will bring erosion.

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Only a few yards away on a gentle slope of 2 percent or less, I look at a soil in a shallow pit. The surface material is undoubtedly local alluvium.

A_1	0 - 6"	Very dark reddish-brown heavy silt loam or very fine sandy clay loam; firm, but easily friable to cheesy granular; many roots of savanna grasses.
A_3	6 - 18"	Dark reddish-brown fine sandy clay loam; easily friable; many roots and insect holes.
B_1	18 - 27"	Brown, slightly reddish concretionary clay loam; easily friable.
B_2	27 - 43" plus	Compact yellowish-brown gravelly clay. Very difficult to dig out. There are large pieces of weathered quartzite.
		In depth one gradually works into rotten rock rich in quartz fragments. There are no definite evidences of lateritic hardpan.

On the same gentle slope about 150 feet away, I look at another profile.

A_1	0 - 7"	Very dark reddish-brown, easily friable silt loam or very fine sandy clay loam.
A_3	7 - 12"	Dark reddish-brown easily friable very fine sandy loam.
B_1	12 - 17"	Dark reddish-brown gravelly (concretionary) loam. The soil digs out easily and is easily friable except for the very hard concretions.
B_2	17 - 36" plus	Hard red lateritic hardpan. Mottled with yellow, purplish-red, and a very little white. The pick leaves intense dark orange-red streaks. The material is reasonably porous.

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B_1	12 - 17"	Dark reddish-brown gravelly (concretionary) loam. The soil digs out easily and is easily friable except for the very hard concretions.
B_2	17 - 36" plus	Hard red lateritic hardpan. Mottled with yellow, purplish-red, and a very little white. The pick leaves intense dark orange-red streaks. The material is reasonably porous.

About 100 feet or so to the side of the first described profile, near the road, there is a surface wash covering of about five inches. At 30 inches below the top of A_1 is a bed of highly weathered quartzite. (An old buried stone line?)

I go over about 350 feet from the first described profile and look at the soil in a cultivated garden.

A_1	0 - 12"(6-20")	Nearly black very fine sandy loam; firm in place, but easily friable.
B_1	6 - 20"(30")	Dark brown gravelly (concretionary) loam.
B_2	20(30) - 36" plus	Very compact stony gravelly clay, yellow, ocher, and red. There are many large pieces of partially weathered quartzite. (Another stone line?)

Thus this area has an extremely complicated pattern of soil profiles. Certainly some of the lateritic hardpans are fossil although it is conceivable that in places they may be in formation. The area has had an intricate, almost micro, pattern of erosion and filling during the formation of the colluvial fans on the slopes. These processes apparently went on at different rates while the old soils were being formed and up to the present time.

There are rather large-scale experiments here on the hills for comparing the usual frequent burning of the savanna with fire protection. Already, after just a few years, there is an enormous difference in the cover. The unburned areas have

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A_1 0 - 12"(6-20") Nearly black very fine sandy loam; firm in place, but readily friable.

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There are rather large-scale experiments here on the mills for comparing the usual frequent burning of the savanna with fire protection. Already, after just a few years, there is an enormous difference in the cover. The unburned areas have

many more shrubs and trees.

M. Jurion and I drive out from the station toward Aru in order to take a characteristic sample of the "Red Loam" in this plain of open savanna with some shrubs and trees. I also take a sample of the principal savanna grasses. The plain is nearly level, with perhaps 1 to 1½ percent slope, and well drained. The elevation is about 1200 meters.

Soil Profile Sample No. 17

A_1	0 - 4½"	Very dark reddish-brown to black granular clay loam. Soil aggregates are held firmly in place by the grass roots. Dark reddish-brown when dry.
A_{30}	4½ - 10"	Very dark reddish-brown clay loam; friable and granular. There are many grass roots but the soil is not quite so firm as in A_1. Dark reddish-brown to red when dry.
A_{31}	10 - 21"	Reddish-brown clay loam, easily friable to fine granular. Red when dry.
A_{32}	21 - 32"	Like A_{31} but slightly lighter in color. Red when dry.
B	32 - 42"	Dark red friable clay loam. Red when dry.
C	42 - 80" plus	Soft mellow, very softly granular clay loam. (Sample C_1 taken at 50 inches and sample C_2 at 70 inches.) Red when dry.

Plant roots extend to 65 inches at least. This should be a good example of the "Red Loam". I suspect there may be a lateritic hardpan at great depth. Of course, the absence of

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A_{32}	21 - 32"	Like A_{31} but slightly lighter in color. Red when dry.
B	32 - 42"	Dark red friable clay loam. Red when dry.
C	42 - 80" plus	Soft mellow, very softly granular clay loam. (Sample C_1 taken at 50 inches and sample C_2 at 70 inches.) Red when dry.

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Table 8. Analyses of Earthy Red Latosol (savanna). (17)

Sample No.	Horizon	Depth	pH	Organic ~~Matter~~ Carbon	Size Class and Diameter of Particles (*in mm.*)							Other Classes (*in mm.*)		
					Very course sand 2–1	Coarse sand, 1–0.5	Medium sand, 0.5–0.25	Fine sand, 0.25–0.1	Very fine sand, 0.1–0.05	Silt, 0.05–0.002	Clay, <0.002	0.02–0.002	<0.005	>2
		Inches		*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
48703	A_1	0–4½	5.0	2.2	1.2	13.1	9.4	15.5	6.3	9.0	45.5	5.4	47.5	0
704	A_{30}	4½–10	4.7	1.7	1.3	9.4	8.3	15.3	6.3	9.2	50.2	5.6	52.0	<0.5
705	A_{31}	10–21	4.5	1.3	2.0	8.2	7.0	13.8	6.6	9.7	52.7	6.0	55.2	<0.5
706	A_{32}	21–32	4.3	1.0	1.6	7.5	6.1	12.9	6.7	8.9	56.3	5.8	58.4	<0.5
707	B_2	32–42	4.6	0.8	1.6	6.9	5.4	12.2	7.0	9.3	57.6	5.9	60.1	<0.5
708	C_1	At 50	4.9	0.6	2.6	5.9	4.7	11.4	6.9	9.4	59.1	5.9	61.2	<0.5
709	C_2	At 70	5.0	0.5	1.7	4.6	4.2	11.5	7.6	10.1	60.3	6.3	62.2	1

Sample No.	Horizon	Depth	Exchangeable Cations me/100 g					Sum of Cations me/100 g	% Base Saturation	Total P	Available P
			Ca	Mg	Mn	K	H			%	ppm.
48703	A_1	0–4½	1.6	0.8	0.03	0.3	11.9	14.6	19	.037	5
704	A_{30}	4½–10	0.7	0.3	0.02	0.2	13.2	14.4	8	.034	21
705	A_{31}	10–21	0.4	0.3	0.02	0.3	14.0	15.0	7		
706	A_{32}	21–32	0.5	0.4	0.02	0.4	12.8	14.1	9		
707	B_2	32–42	0.3	0.2	0.02	0.3	10.8	11.6	7	.028	4
708	C_1	At 50	0.2	0.2	0.02	0.4	9.2	10.0	8	.030	4
709	C_2	At 70	0.2	0.2	0.01	0.3	8.4	9.1	8		

Congo Soil Profile No. 17

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Sand Classes and Diameter of Particles (in mm.)

Sample No.	Horizon	Depth	pH	Organic Matter	Very coarse sand 2-1	Coarse sand 1-0.5	Medium sand 0.5-0.25	Fine sand 0.25-0.1	Very fine sand 0.1-0.05	Silt 0.05-0.002	Clay <0.002	Fe 0.05-0.002	Fe <0.002	Other Classes (in mm.)
														>2
4870S	A	0-4	5.0	2.2	1.3	17.1	9.4	15.2	6.3	9.0	42.5	2.4	47.5	0
704		4-10	4.7	1.4	0.3	8.4	8.5	15.3	6.5	8.3	50.3	2.6	52.9	0.5
705		10-15	4.3	0.8	0.3	7.2	7.0	12.9	6.7	7.8	57.3	2.0	59.3	0.5
706	B	15-23	4.3	0.8	0.3	7.2	7.0	12.9	6.7	8.3	56.8	2.0	58.8	0.5
707		23-43	4.3	0.8	0.3	7.2	7.0	12.9	6.7	8.3	56.8	2.0	58.8	0.5
708		43-80	4.3	0.8	0.3	7.2	7.0	12.9	6.7	8.3	56.8	2.0	58.8	0.5
709	C	80 & over	5.0	0.6	0.3	7.3	7.0	13.1	6.8	10.1	50.9	2.4	53.3	0.4

Horizon A

Sample No.	Depth	pH	Organic Matter	Very coarse sand 2-1	Coarse sand 1-0.5	Medium sand 0.5-0.25	Fine sand 0.25-0.1	Very fine sand 0.1-0.05	Silt 0.05-0.002	Clay <0.002	Fe 0.05-0.002	Fe <0.002	Other Classes (in mm.)
													>2
4870S	0-4	5.0	2.2	1.3	17.1	9.4	15.2	6.3	9.0	42.5	2.4	47.5	0
704	4-10	4.7	1.4	0.3	8.4	8.5	15.3	6.5	8.3	50.3	2.6	52.9	0.5
705	10-15	4.3	0.8	0.3	7.2	7.0	12.9	6.7	7.8	57.3	2.0	59.3	0.5
706	15-23	4.3	0.8	0.3	7.2	7.0	12.9	6.7	8.3	56.8	2.0	58.8	0.5
707	23-43	4.3	0.8	0.3	7.2	7.0	12.9	6.7	8.3	56.8	2.0	58.8	0.5
708	43-80	4.3	0.8	0.3	7.2	7.0	12.9	6.7	8.3	56.8	2.0	58.8	0.5
709	80 & over	5.0	0.6	0.3	7.3	7.0	13.1	6.8	10.1	50.9	2.4	53.3	0.4

Horizon B

Sample No.	Depth	pH	Organic Matter	Very coarse sand 2-1	Coarse sand 1-0.5	Medium sand 0.5-0.25	Fine sand 0.25-0.1	Very fine sand 0.1-0.05	Silt 0.05-0.002	Clay <0.002	Fe 0.05-0.002	Fe <0.002	Other Classes (in mm.)
													>2
4870S	0-4	5.0	2.2	1.3	17.1	9.4	15.2	6.3	9.0	42.5	2.4	47.5	0
704	4-10	4.7	1.4	0.3	8.4	8.5	15.3	6.5	8.3	50.3	2.6	52.9	0.5
705	10-15	4.3	0.8	0.3	7.2	7.0	12.9	6.7	7.8	57.3	2.0	59.3	0.5
706	15-23	4.3	0.8	0.3	7.2	7.0	12.9	6.7	8.3	56.8	2.0	58.8	0.5
707	23-43	4.3	0.8	0.3	7.2	7.0	12.9	6.7	8.3	56.8	2.0	58.8	0.5
708	43-80	4.3	0.8	0.3	7.2	7.0	12.9	6.7	8.3	56.8	2.0	58.8	0.5
709	80 & over	5.0	0.6	0.3	7.3	7.0	13.1	6.8	10.1	50.9	2.4	53.3	0.4

Horizon C

Sample No.	Depth	pH	Organic Matter	Very coarse sand 2-1	Coarse sand 1-0.5	Medium sand 0.5-0.25	Fine sand 0.25-0.1	Very fine sand 0.1-0.05	Silt 0.05-0.002	Clay <0.002	Fe 0.05-0.002	Fe <0.002	Other Classes (in mm.)
													>2
4870S	0-4	5.0	2.2	1.3	17.1	9.4	15.2	6.3	9.0	42.5	2.4	47.5	0
704	4-10	4.7	1.4	0.3	8.4	8.5	15.3	6.5	8.3	50.3	2.6	52.9	0.5
705	10-15	4.3	0.8	0.3	7.2	7.0	12.9	6.7	7.8	57.3	2.0	59.3	0.5
706	15-23	4.3	0.8	0.3	7.2	7.0	12.9	6.7	8.3	56.8	2.0	58.8	0.5
707	23-43	4.3	0.8	0.3	7.2	7.0	12.9	6.7	8.3	56.8	2.0	58.8	0.5
708	43-80	4.3	0.8	0.3	7.2	7.0	12.9	6.7	8.3	56.8	2.0	58.8	0.5
709	80 & over	5.0	0.6	0.3	7.3	7.0	13.1	6.8	10.1	50.9	2.4	53.3	0.4

Exchangeable Cations

Sample No.	Depth	pH	Organic Matter	Very coarse sand 2-1	Coarse sand 1-0.5	Medium sand 0.5-0.25	Fine sand 0.25-0.1	Very fine sand 0.1-0.05	Silt 0.05-0.002	Clay <0.002	Fe 0.05-0.002	Fe <0.002	Other Classes (in mm.)
													>2
4870S	0-4	5.0	2.2	1.3	17.1	9.4	15.2	6.3	9.0	42.5	2.4	47.5	0
704	4-10	4.7	1.4	0.3	8.4	8.5	15.3	6.5	8.3	50.3	2.6	52.9	0.5
705	10-15	4.3	0.8	0.3	7.2	7.0	12.9	6.7	7.8	57.3	2.0	59.3	0.5
706	15-23	4.3	0.8	0.3	7.2	7.0	12.9	6.7	8.3	56.8	2.0	58.8	0.5
707	23-43	4.3	0.8	0.3	7.2	7.0	12.9	6.7	8.3	56.8	2.0	58.8	0.5
708	43-80	4.3	0.8	0.3	7.2	7.0	12.9	6.7	8.3	56.8	2.0	58.8	0.5
709	80 & over	5.0	0.6	0.3	7.3	7.0	13.1	6.8	10.1	50.9	2.4	53.3	0.4

Sum of Cations

Sample No.	Depth	pH	Organic Matter	Very coarse sand 2-1	Coarse sand 1-0.5	Medium sand 0.5-0.25	Fine sand 0.25-0.1	Very fine sand 0.1-0.05	Silt 0.05-0.002	Clay <0.002	Fe 0.05-0.002	Fe <0.002	Other Classes (in mm.)
													>2
4870S	0-4	5.0	2.2	1.3	17.1	9.4	15.2	6.3	9.0	42.5	2.4	47.5	0
704	4-10	4.7	1.4	0.3	8.4	8.5	15.3	6.5	8.3	50.3	2.6	52.9	0.5
705	10-15	4.3	0.8	0.3	7.2	7.0	12.9	6.7	7.8	57.3	2.0	59.3	0.5
706	15-23	4.3	0.8	0.3	7.2	7.0	12.9	6.7	8.3	56.8	2.0	58.8	0.5
707	23-43	4.3	0.8	0.3	7.2	7.0	12.9	6.7	8.3	56.8	2.0	58.8	0.5
708	43-80	4.3	0.8	0.3	7.2	7.0	12.9	6.7	8.3	56.8	2.0	58.8	0.5
709	80 & over	5.0	0.6	0.3	7.3	7.0	13.1	6.8	10.1	50.9	2.4	53.3	0.4

% Base Saturation

Sample No.	Depth	pH	Organic Matter	Very coarse sand 2-1	Coarse sand 1-0.5	Medium sand 0.5-0.25	Fine sand 0.25-0.1	Very fine sand 0.1-0.05	Silt 0.05-0.002	Clay <0.002	Fe 0.05-0.002	Fe <0.002	Other Classes (in mm.)
													>2
4870S	0-4	5.0	2.2	1.3	17.1	9.4	15.2	6.3	9.0	42.5	2.4	47.5	0
704	4-10	4.7	1.4	0.3	8.4	8.5	15.3	6.5	8.3	50.3	2.6	52.9	0.5
705	10-15	4.3	0.8	0.3	7.2	7.0	12.9	6.7	7.8	57.3	2.0	59.3	0.5
706	15-23	4.3	0.8	0.3	7.2	7.0	12.9	6.7	8.3	56.8	2.0	58.8	0.5
707	23-43	4.3	0.8	0.3	7.2	7.0	12.9	6.7	8.3	56.8	2.0	58.8	0.5
708	43-80	4.3	0.8	0.3	7.2	7.0	12.9	6.7	8.3	56.8	2.0	58.8	0.5
709	80 & over	5.0	0.6	0.3	7.3	7.0	13.1	6.8	10.1	50.9	2.4	53.3	0.4

Total P

Sample No.	Depth	pH	Organic Matter	Very coarse sand 2-1	Coarse sand 1-0.5	Medium sand 0.5-0.25	Fine sand 0.25-0.1	Very fine sand 0.1-0.05	Silt 0.05-0.002	Clay <0.002	Fe 0.05-0.002	Fe <0.002	Other Classes (in mm.)
													>2
4870S	0-4	5.0	2.2	1.3	17.1	9.4	15.2	6.3	9.0	42.5	2.4	47.5	0
704	4-10	4.7	1.4	0.3	8.4	8.5	15.3	6.5	8.3	50.3	2.6	52.9	0.5
705	10-15	4.3	0.8	0.3	7.2	7.0	12.9	6.7	7.8	57.3	2.0	59.3	0.5
706	15-23	4.3	0.8	0.3	7.2	7.0	12.9	6.7	8.3	56.8	2.0	58.8	0.5
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708	43-80	4.3	0.8	0.3	7.2	7.0	12.9	6.7	8.3	56.8	2.0	58.8	0.5
709	80 & over	5.0	0.6	0.3	7.3	7.0	13.1	6.8	10.1	50.9	2.4	53.3	0.4

Available P

Sample No.	Depth	pH	Organic Matter	Very coarse sand 2-1	Coarse sand 1-0.5	Medium sand 0.5-0.25	Fine sand 0.25-0.1	Very fine sand 0.1-0.05	Silt 0.05-0.002	Clay <0.002	Fe 0.05-0.002	Fe <0.002	Other Classes (in mm.)
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4870S	0-4	5.0	2.2	1.3	17.1	9.4	15.2	6.3	9.0	42.5	2.4	47.5	0
704	4-10	4.7	1.4	0.3	8.4	8.5	15.3	6.5	8.3	50.3	2.6	52.9	0.5
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Exchangeable Cations

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Available P

| Sample No. | Depth | pH | Organic Matter | Very coarse sand 2-1 | Coarse sand 1-0.5 | Medium sand 0.5-0.25 | Fine sand 0.25-0.1 | Very fine sand 0.1-0.05

quartz fragments suggests that the material was reworked by water at some stage in the geomorphological cycle. So far as I can tell here on the ground this is the savanna equivalent of soil No. 6 under the forest and the end member of the soil association in this area, not truncated.

We go back to the experiment station and I walk out into the mulberry plantings. Here I see a bad weed grass that somewhat resembles our crab grass -- Digitaria scalarum. Although a bad nuisance, it is a good plant for erosion control and makes fair pasture. Often it comes in on cultivated land and thus forces the natives to return the land to fallow. It spreads by rhizomes.

At the station attempts are being made to develop a better strain of mulberry that can withstand competition from this and other grasses and thus avoid the great expense of weeding. These mulberries are pruned much like grapes in southern France. The plants are now about 30 inches high with a few lateral branches up to 8 feet.

I notice that in this area some sisal is also grown for home use in making ropes.

Walking around this area near the station is about like walking through a geological museum. There is a great mixture of granite, gneiss, and other quartz-bearing igneous rocks all confused with varying kinds and depths of colluvium.

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K-1399 June 10, 1947
Belgian Congo. Between Mt. Hawa and Aru. Typical savanna on "Red Loam." (Site of sample No. 17.)

K-1399 June 10, 1947
Belgian Congo. Between Mt. Hawa and Ara.
Typical savanna on "Red Loam." (Site of
sample No. 17.)

I look in a moment at the local school. Most of the pupils are boys but there are a few girls. They have two native professors. There is essentially no furniture in the room. The students sit on the floor and each has a little slate. They repeat their lessons together after the teacher, much as they did in the old days in the United States, as described in The Legend of Sleepy Hollow.

Just as we leave Mount Hawa for Nioka I stop in a little village that is devoted to silkworm production. The village is about one-half kilometer long and has 21 silkworm sheds. Two men look after the work in one shed. On one side of the village is the mulberry planting to furnish leaves for the silkworms. Then comes a straight row of the rectangular silkworm sheds. Back of these is a row of sisal. Next are the circular huts of the native families. Behind these are the circular kitchen huts. Back of each kitchen is a group of circular thatched graneries sitting on stilts. Then comes a row of Eucalyptus trees. Finally on the other side of the village are the food crops and the road.

After leaving the village we are on gently rolling reddish-brown soil, at least partly from granite, under open savanna. Here there are numerous termite mounds but they are very small. At 22 kilometers we come into a gently rolling country with a cover of bamboo savanna. This is a mixture of

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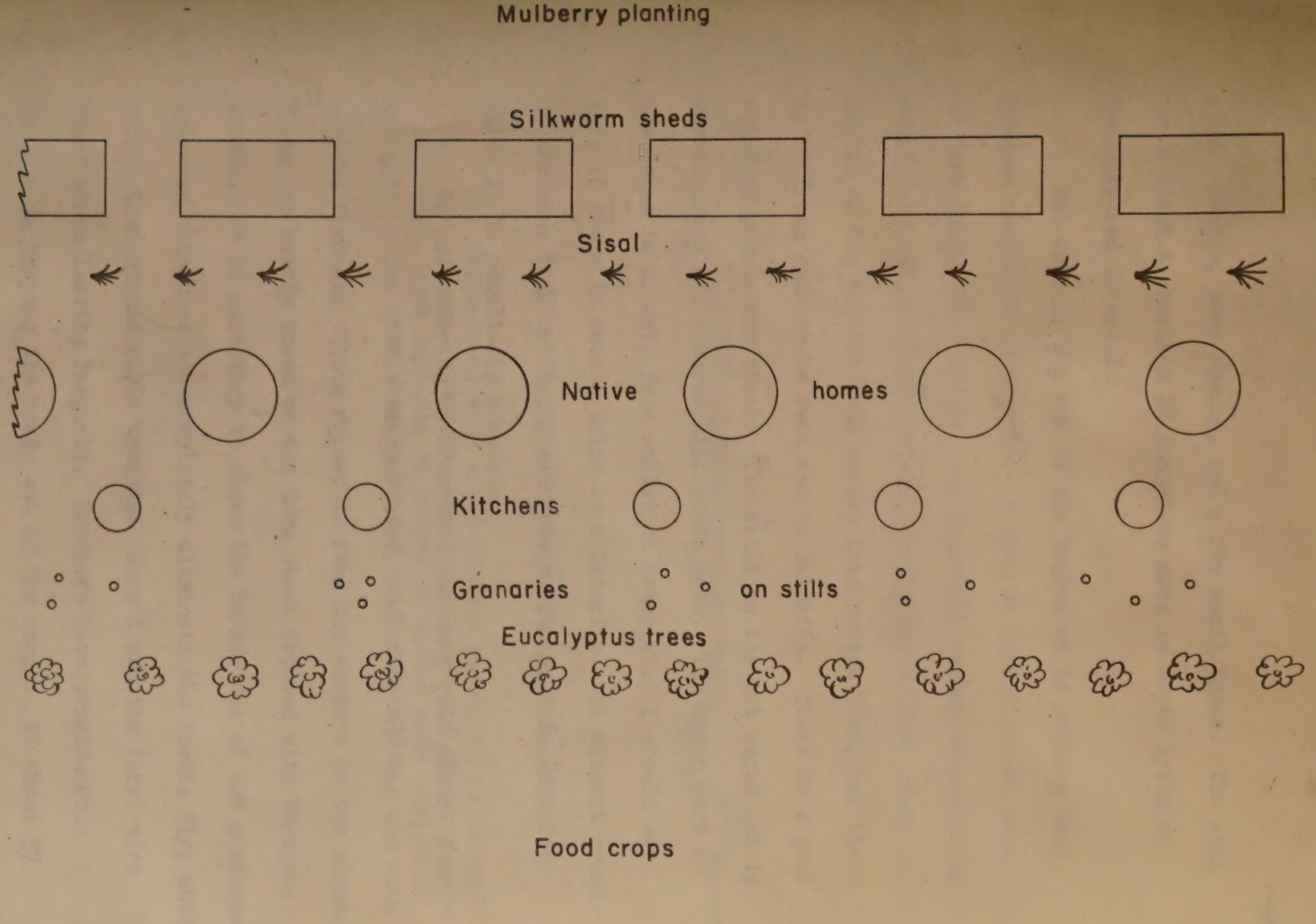

Schematic section of native silkworm village

(Has total of 21 sheds and is 500 meters long.)

grass, bamboo, some shrubs, and a few small trees. The soil has a black A_1 horizon 12 inches or more in depth lying on gravelly red material.

But we soon are out of the bamboo on to rolling land between mountains of diorite. I stop to look at a cut some 10 feet deep. The surface soil is reddish-brown underlain by vivid deep red material that is friable and mellow. Near the bottom of the cut the soil merges into rotten rock, but there is no fresh rock to be seen and no laterite. There is a good stand of pennisetum grass. The soils in the cut stand nearly vertical and are covered with green moss. The upper part of the solum is clearly from colluvial material. I should say that if there is such a thing as a laterite soil without crust or hardpan, this is it. I see some coffee on this land for which it is peculiarly adapted.

We are entering an area that has many gold mines. There are quite a few cattle ranches here, including one big one with several thousand cattle raised to feed the workers in the mines. These are mostly based on the Zebu stock crossed with European breeds. It is necessary to clean the bushes out of the pastures, but even this does not completely eliminate the Tsetse fly, which still gives considerable trouble. Here I see the first wire fence since leaving Yangambi. Ranchers have considerable trouble in keeping the weeds out of the range. At about 37

grass, bamboo, some shrubs, and a few small trees. The soil has a black A_1 horizon 12 inches or more in depth lying on gravelly red material.

But we soon are out of the bamboo on to rolling land between mountains of diorite. I stop to look at a cut some 10 feet deep. The surface soil is reddish-brown underlain by vivid deep red material that is friable and mellow. Near the bottom of the cut the soil merges into rotten rock, but there is no fresh rock to be seen and no laterite. There is a good stand of pennisetum grass. The soils in the cut stand nearly vertical and are covered with green moss. The upper part of the solum is clearly from colluvial material. I should say that if there is such a thing as a laterite soil without crust or hardpan, this is it. I see some coffee on this land for which it is peculiarly adapted.

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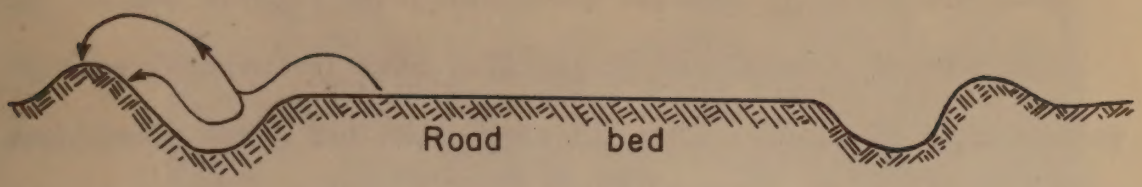

Sketch showing highway cross-section

The vegetation, with a bit of soil material, is scraped off the road shoulders and ditch banks and thrown on the edge, thus building up ridges on either side that spoil the road banks for soil examination.

kilometers from Mount Hawa we pass the headquarters of one of the big ranches -- the Kererere Ranch. Nearby we pass a deep cut with soft schist exposed. Near the ranch headquarters I notice that there is significant overgrazing resulting in some accelerated erosion. It is interesting to see the cowboys here on foot and carrying bows and arrows. We pass a few thick Eucalyptus groves. This tree grows fairly well here and serves for windbreaks and for soil protection in critical places.

For several days, and today especially, I am irritated by some features of road building in the Congo. The workers completely spoil the road banks for soil study. In this country the grass and weeds come into the roadsides rapidly and thickly--not only over the road shoulders, but also onto the road itself where there is not much travel. Natives scrape off this vegetation, along with a little soil, and simply throw it up on the banks. Thus just above each ditch bank there is a ridge built up from this debris continually being carried out of the road. In fact, many of these roads give an appearance of being sunken into the landscape in a way that suggests erosion, but it is due to this method of disposing of the waste. Thus most road banks are contaminated and unsuitable for soil examination.

At 58 kilometers we pass into an area of rolling deep red soils with good native farms. They are growing maize, grain sorghum, bananas, and other food crops. They have some very

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Belgian Congo. North of Nioka.
Native zebu cattle going to market.

P-XXXIX

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We are stopped at the village of Djalasiga for police control. It seems that rather careful records are kept of Europeans going in and out of this region because some of them are inclined to make deals with the natives who might be encouraged to steal gold from the mines. This is a rather large native village with a fair area of food crops. They have a nice planting of Eucalyptus and Filas trees for protection.

This general area is underpopulated in relation to the potentialities of the soil, but it is difficult to make shifts from some of the overpopulated areas because of the tribal land customs. Of course, in the old days the differences in population were adjusted through tribal wars. These are no longer permitted. Most of the natives in this region do not live along the road but back in the bush. We pass some broad undulating areas with nearly open savanna and a few relicts of gallery forest.

At 100 kilometers we are still on a winding road in rolling savanna with strong deep red soil. We are gradually going higher into the granitic area. In this region there are a few white farmers from Belgium and south Africa, and even one American.

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native tribes may be grouped into two general types -- the Sudanese and the Bantu. Since leaving Yangambi most of the tribes belong with the Sudanese. East of us is the Alur tribe.

We come into a high region with soil from granite. There is quite a bit of quartz sand in it and the surface soil is inclined to be very loose. On the whole, it is rather poor for crops. I notice that the high rolling plains to the south have very few trees. The soil along the road has a loose, rich, dark brown surface soil with loose dark red soils just underneath it. Here the main grass in the savanna is Loudetia.(?) I take a picture of the native Zebu cattle. These happen to belong to a cattle breeder by the name of Vanthielen -- an American citizen of Belgian descent.

In the Mount Rona district, about 120 kilometers from our starting point, there are soils from granite with deep black loose A_1 horizons. We pass a forest plantation belonging to the natives of about 1,000 acres started by Director Jurion in 1932. The trees are mainly cyprus -- not a good species for soil building. Within the forest the dense shade has eliminated practically all of the ground cover. The surface A_1, about 6 to 12 inches deep, is a black granular heavy loam. This is underlain by firm, easily friable, granular very dark brown soil and, at about 30 inches, by red sandy clay. There is rotten granite at variable depths. There are a good many huge granite boulders on the surface. In other places the soil is somewhat

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lighter colored beneath the black A_1 and quite sandy. The soils vary a good deal locally and irregularly in these hills according to slope and the composition of the granite. Nearly all the soil material has been moved about through local creep and local wash.

Director Jurion points out that forest production is a very good proposition for the natives in this area. These trees are about 15 years old or less and are now 6 to 15 inches d.b.h. They make excellent mine props for which there is an active demand and no other good supply nearby.

South of this forest we enter a region of excessive population.

We stop 28 kilometers northwest of Nioka and look at the soil in a cut through a slope of about 5 to 7 percent. The vegetation is savanna with some shrubs and low trees. The natives grow fair corn, some sweet potatoes, poor cassava, and a few bananas in the more moist places.

This is not an ideal place to look at the soil. The surface soil has some overburden from road operations, but there is no help for it. The black surface and the red B are derived from the granite.

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Soil Profile Sample No. 18

A_1	0 - 12"	Nearly black granular heavy loam Very dark red to black when dry.
A_3	12 - 18"	Very dark reddish-brown coarse sandy clay or clay loam . Dark red to dark reddish-brown when dry.
B_1	18 - 30"	Dark red coarse sandy clay, Red to dark reddish-brown when dry.
B_2	30 - 50"	Red sandy clay loam with small black concretions and a little fine mottling. Yellowish-red and reddish-yellow when dry.
B_3 or C	50 - 70" plus	Mottled and streaked red, yellow, and very dark red rotten rock. Reddish-yellow when dry.
D(?)		Granite.? (Sample is taken from hard stones imbedded in the rotten rock and may not be typical of the rock as a whole.) (Quartz diorite ?)

The total depth of material to the rock is quite variable. On the opposite bank I see some beautiful stone lines. There are diagonal veins of quartz extending up through the B_3 and ending near the boundary of B_2 and B_3 in a general stone line. When dry, A_1, A_3, and the upper B_1 crack into beautiful prisms about 3 inches in diameter. I believe this to be a good example of the black-red soils from granite. It is probably common that the upper part of the solum is developed from material that has been moved at least a little from its original position.

The natives are doing a fair job of strip-cropping in this strongly rolling area. During the last 20 years the population has doubled. A great deal of the land is in farms. (South of Nioka the people belong to the Balendu tribe.)

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Table 20. Analyses of Black-Red Latosol. (18)

Sample No.	Horizon	Depth	pH	Organic ~~Matter~~ Carbon	Size Class and Diameter of Particles (*in mm.*)							Other Classes (*in mm.*)		
					Very course sand 2–1	Coarse sand, 1–0.5	Medium sand, 0.5–0.25	Fine sand, 0.25–0.1	Very fine sand, 0.1–0.05	Silt, 0.05–0.002	Clay, <0.002	0.02–0.002	<0.005	>2
		Inches		*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
48710	A_1	0–12	6.1	5.5	6.7	12.5	7.0	9.2	6.0	26.3	32.3	17.2	38.1	<0.5
711	A_3	12–18	5.7	2.0	5.9	9.9	5.4	7.9	5.6	24.3	41.0	14.5	45.8	0
712	B_1	18–30	5.5	1.1	3.4	5.6	3.2	5.7	5.3	22.2	54.6	14.0	59.7	0
713	B_2	30–50	5.7	0.4	5.4	7.2	3.0	6.9	7.2	31.2	39.1	21.5	46.2	0
714	B_3	50–70+	5.8	0.2	18.9	20.6	3.8	4.6	7.3	33.8	11.0	20.8	15.8	0

Sample No.	Horizon	Depth	Exchangeable Cations me/100 g					Sum of Cations me/100 g	% Base Saturation
			Ca	Mg	Mn	K	H		
48710	A_1	0–12	19.5	7.8	0.38	1.9	9.8	39.4	75
711	A_3	12–18	8.6	4.7	0.13	0.9	11.6	25.9	55
712	B_1	18–30	6.7	4.3	0.03	0.7	11.8	23.5	50
713	B_2	30–50	8.8	5.2	0.02	0.6	10.0	24.6	59
714	B_3	50–70+	7.0	4.5	0.02	0.4	4.9	16.8	71

Congo Soil Profile No. 18

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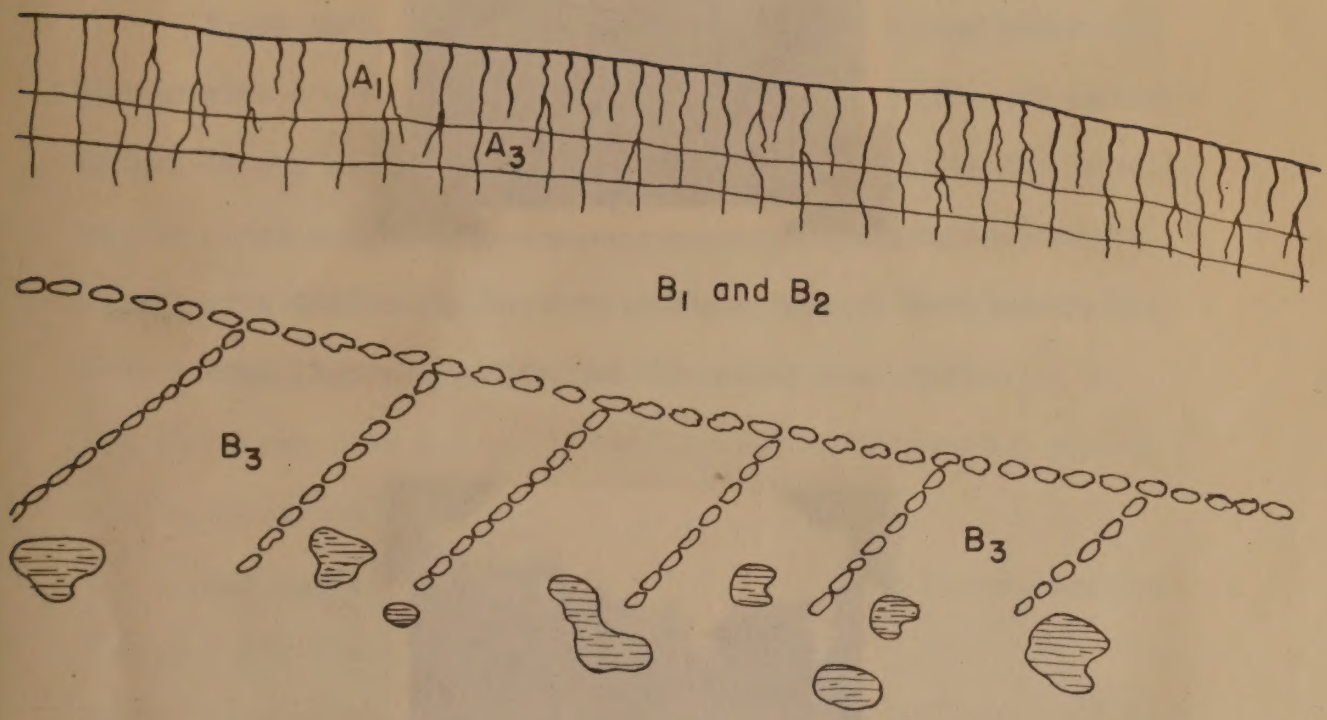
Table 20. Analyses of Black-Jack Mesa soil. (18)

Sample No.	Horizon	Depth	pH	Organic Matter Carbon	Very coarse sand 2-1	Coarse sand 1-0.5	Medium sand 0.5-0.25	Fine sand 0.25-0.1	Very fine sand 0.1-0.05	Silt 0.05-0.002	Clay <0.002	Other Classes (in mm.) 0.002-0.005	<0.005	>2
					Size Class and Diameter of Particles (in mm.)									
					Mechanical Analysis									
					Ca Mg	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
48710	A1	0-12	6.1	0.8	0.1	12.5	7.0	9.2	6.0	25.3	33.3	17.3	28.1	<0.5
711	B1	12-18	5.7	0.5	0.2	9.3	8.4	7.3	5.6	24.3	41.0	14.3	45.8	0
712	B2	18-30	5.2	0.4	0.4	7.2	5.3	5.7	5.2	22.3	54.6	14.0	59.1	0
713	C	30-60	5.4	0.3	0.4	7.3	5.3	5.3	7.3	21.3	53.1	21.3	45.3	0
714		60-70+	5.8	0.3	0.3	20.6	5.8	4.6	1.3	23.8	44.0	20.8	12.8	0
			Ca	Mg	Meq/100 g.									
		0-12	15.3	4.8	0.8	1.8	2.8	4.8	2.8					
		12-18	8.3	4.7	0.3	0.9	1.3	2.3	1.3					
		18-30	6.7	4.3	0.1	0.9	0.8	2.3	0.9					
		30-60	6.8	3.3	0.0	0.6	0.6	2.6	0.8					
		60-70+	7.0	4.3	0.0	0.6	0.8	3.8	1.3					

Compo Soil Profile No. 18

S-6888-1 10—SANTA ROSA PRINTING CO. S. F.



Stone line in deep road cut 28 kilometers north of Nioka
(Site of Sample No. 18)

Stone lines in road cut north of Nioka at site of soil profile sample No. 18. (Photos by Jurion.)

Stone lines in road cut north of Nioka at site of soil profile sample No. 18. (Photos by Durion.)

Now the sun is going down and little more can be done. We arrive at the experiment station at Nioka about 6 p.m., just at twilight. It is cool. The elevation is about 5,000 feet and the rainfall about 47 inches.

Quite a few people here are sick. They are said to have the "flu". I increase my quinine intake from ½ gram to 1 gram.

I get very sleepy waiting for dinner and then after dinner have a bad headache, but we go almost immediately after dinner to our hotel where I have a nice little house for myself and my first good hot bath since being in the Congo. Tonight I have some difficulty in straightening out my back, but it has been a long time since it's had its usual treatments.

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June 11:- At Nioka

I didn't have a very good night. I had a bad headache when I went to bed and was awakened from time to time during the night with my ears ringing from the heavy dose of quinine. They are still ringing this morning when I get up early and go out to the experiment station for breakfast.

Near the headquarters I see some Acacia decurrens. One needs only to plant the seed. The trees grow thick and straight. They are good for poles, temporary buildings, firewood, and tannin. They have only a little value for soil regeneration. They live about 15 to 20 years and reach about 18 inches d.b.h.

There is some arabica coffee, like the major type in Brazil, grown here but it is not too good. Production can be increased with heavy applications of manure.

I stop in at a native tailor's shop and he measures me for some new khaki pants.

This station has about 12,000 hectares of land. This includes about 100 hectares of pasture improved through cultivation and another 100 hectares improved by intensive grazing and parking at night. They have about 2500 head of cattle, partly for dairy, but mostly for beef. The station employs about 600 native workers who have their gardens on the station. The natives also receive meat, salt, palm oil, etc. as supplementary rations. The main problems of the station include

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(1) cattle breeding, (2) pasture improvement, (3) food crops, (4) permanent crops like coffee, cinchona, and tung, and (5) forestry. They expect to expand the work in forestry, particularly in relation to soil conservation on critical slopes. The present professional staff includes one veterinarian, two agronomists, and a botanist.

In the beginning the station started with native cattle and sought to improve them by crossing with European breeds. They made selections from the native breeds and also started experiments in hybridization. The three native breeds are as follows: (1) Lugware, one of the African Zebus. These are small cattle weighing about 210 kilos. (2) A local type of African Zebu, intermediate in size. (3) Bahama cattle of large size weighing about 320 kilos. In addition, they plan to obtain some Indian Zebus. They are using four European breeds: (1) Fresian, (2) Shorthorn, (3) Jersey, and (4) Ayrshire. They choose the best animals from crossing the European breeds with selections from the native breeds. The most economical cross is obtained with purebred European bulls on native cows. The backcrosses with European bulls are not so resistant to this environment as the first cross. But these non-resistant ones are backcrossed with native bulls. Then by crossing the results of this backcross they hope for both resistance and improved quality. Their present opinion is that successful cattle must have not less than 37 percent native blood.

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(a)

(b)

(c)

(d)

At Nioka: (a) Cows from Freisan cross, (b) local type of indigenous bull, (c) local type Lugmare bull, (d) local type of Bahama bull. (Photos by Jurion.)

At Nioka: (a) Cows from Freisan cross, (b) local type of indigenous bull, (c) local type Lugmare bull, (d) local type of Bahama bull. (Photos by Jurion.)

From crosses of native cows with good European bulls about 10 percent of the heifers make good dairy cows. Then they get about 50 percent good dairy cows on the first backcross.

Close inbreeding of native cattle gives poor results with many deformed specimens and no good ones.

I go to look at the cattle and take photographs. (This is somewhat difficult because my ears are ringing dreadfully from the quinine.) I look at some mature cows resulting from a first cross of native cows with a Fresian bull. These cows give about 2,000 liters of milk whereas the native cows rarely give over a thousand liters and the average is about 250. But this native milk is rather high in butterfat, say around 6 or 7 percent. The hump of the native cattle disappears in the first cross. With the second cross on the Fresian, cows are obtained that give 3,000 liters per lactation.

I am impressed with the enormous amount of work required at this station in order to keep individual records on these 2,500 cattle. Some of the purebred European cattle look good as well as the crossbreeds. I see one crossbred Fresian that gives 6,000 liters of milk per lactation.

The soil on these pastures is much like soil profile No. 18. Most of it is rolling to strongly rolling. I look at a profile from granite near the top of a broad hill on a slope of about 4 to 5 percent. There are no significant termite mounds.

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Soil Profile Sample No. 19

A_1	0 - 8"	Very dark reddish-brown to nearly black granular clay loam. The aggregates are firmly held by grass roots but are easily friable. To purplish gray when dry.
A_3	8 - 16"(14-18")	Dark reddish-brown granular clay loam with some coarse sand and pebbles.
B_2	16 - 38"	Red to dark red easily friable clay with some sand and pebbles. Aggregates are even more easily friable than in A.
B_3	38 - 43" plus	Mottled bright red and dark red friable clay with some sand and pebbles. It is too bad that the pit is not a bit deeper. There are few, if any, small concretions.

M. Jurion regards this soil as typical for the experiment station. I collect only a sample of the A_1 and of the principal pasture grass -- Cynodon plectostachyum. Here there is a very even stand of grass but severe overgrazing greatly reduces the quality.

On the station I also see quite a few small horses. They have a few sheep, but after some trial have decided that the area is too wet for sheep. They suffer from parasites and do poorly.

They have had no cases of phosphorus deficiency in cattle so far as they know, but they do have some with horses if the

Soil Profile Sample No. 19

A_1	0 - 8"	Very dark reddish-brown to nearly black granular clay loam. The aggregates are firmly held by grass roots but are easily friable. To pumpkish gray when dry.
A_3	8 - 16"(14-18")	Dark reddish-brown granular clay loam with some coarse sand and pebbles.
B_2	16 - 38"	Red to dark red easily friable clay with some sand and pebbles. Aggregates are even more easily friable than in A.
B_3	38 - 43" plus	Mottled bright red and dark red friable clay with some sand and pebbles. It is too bad that the pit is not a bit deeper. There are few, if any, small concretions.

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K-1400 June 11, 1947
Belgian Congo. Nioka. View of pasture lands at station (near site of sample No. 19). One of the main grasses is Cynodon plectostachyum.

K-1518 June 11, 1947
Belgian Congo. Nioka. Arabica coffee on soil from granite. Windbreak at left is Grevillea robusta. Shade trees are Albizzia stipulata.

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Shade trees are Albizzia stipulata.

animals are fed wholly on local feed.

I see the results of crossing a European bull on native cows, then backcrossed with a European bull and finally crossed with a native bull to get good Shorthorn calves. I see similar results with Fresian cattle. All these experiments are run with large groups of animals and each animal has its individual record.

I look at another profile from granite part way down a long gentle slope of about 3 percent. This soil probably receives a bit more water than No. 19. It is a great pity the pit is not about 2 feet deeper.

A_1	0 - 5½"	Very dark reddish-brown to black granular clay; firm but quite easily friable.
A_3	5½ - 10"	Dark reddish-brown granular clay; firm but rather easily friable.
B_1	10 - 15"	Reddish-brown granular clay; firm in place but easily friable.
B_{20}	15 - 29"	Reddish-brown granular to sub-angular fine nut clay; firm but easily friable. There is a very fine black mottling but without concretions. Perhaps some are just developing.
B_{21}	29 - 42"	Dark reddish-brown clay. Medium-rounded nut to granular; quite firm but easily friable; strongly streaked and mottled with very dark brown to black.
B_3	42 - 45" plus	Reddish-brown clay with many small quartzite fragments; compact in place but fairly easily friable. The soil is mottled with orange, yellow, and very dark brown. Perhaps this is a stone line.

There are grass roots throughout the profile. Pasture is good; it has been improved by close parking.

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I go through a large planting of arabica coffee under shade. With cool nights and sunny days, shade is essential. The coffee looks good but Director Jurion doubts whether coffee can be produced here economically.

Around the station I see many plantings of forest trees in strips, along the roadsides, and in small areas.

I look at a lithosol from schist with an extremely variable profile.

Soil Profile Sample No. 20

A_1	0 - 1 or 6	Dark gray granular clay. Pinkish-gray to light brown when dry.
A_3		In cracks between the rocks; brown granular cheesy clay. Pink when dry.
C		Bluish-gray rotten schist mottled with pink.
D	at 10 feet	Hard schist.

This is only a freak outcrop, but one of the few places I have seen where one may obtain a sample of hard rock with weathered rock and soil above it.

I now go over to the food crop section of the station where I note they are using some woody legumes in the fallow. I look at the soil profile where the savanna grasses are 3 to 5 feet tall. These are mainly elephant grass and especially Hypparhenia cymbaria. This soil occurs in the upland on a slope of about $1\frac{1}{2}$ to $2\frac{1}{2}$ percent.

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A_1	0 - 5"	Black firm granular clay with many roots.
A_3	5 - 10"	Very dark reddish-brown granular clay
B_1	10 - 19"	Friable red granular clay with some coarse sand.
B_2	19 - 40"	Red, with very little orange, granular clay; firm in place but easily friable.
B_3	40 - 60" plus	Softer dark red granular clay.
C		Weathered granite very deep.

There are many roots in the surface and some go down to 60 inches. I see no concretions.

This is a beautiful soil in both structure and color. Here, in contrast to Yangambi, it is desirable to have a well-granulated soil.

After 3 to 5 years' cultivation the surface of this soil becomes very loose like coarse sand. On the station they had been plowing during the dry season in order to be ready for planting. But under this kind of plowing the soil seems to dry out too much and there may be some harmful biological effect which makes it become so loose. The natives don't plow in the dry season but wait for the first rains. They usually have two or three years of cultivation between fallows.

I see plots of maize, Irish potatoes, and Amaranthus (a native food of oily seeds). The maize looks good and might run from 2 to 3 tons of grain per hectare. Potatoes are quite variable and run from 5 to12 tons per hectare. I see some fair looking

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beans. Oats look only fair. The station is just now experimenting with some flax and other crops. The sweet potatoes look good and run about 17 tons per hectare. For their best yield they have gotten 26 tons in the first cultivation.

Sweet potatoes must come first in the rotation. After these come maize and then beans, but the natives normally grow the maize and beans together.

They are just beginning to do quite a bit of plant breeding work with maize, Eleusine (a grass from which the natives use oily seeds as food), grain sorghums, and Amaranthus. They also test varieties of other crops. That is, several stations in the Congo breed certain crops and test these varieties as well as varieties from other stations and from the outside.

Cassava is grown by the natives and on the station, but it doesn't do particularly well. They have gotten about 26 tons of wet roots per hectare from a crop on the land two years at the station.

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Soil Profile Sample No. 21

This is a shallow phase of soil on the granite, on a side hill with about 7 percent slope.

A_1	0 - 6 or 10"	Very dark brown to black coarse sandy clay loam; firm but easily friable. Purplish-gray when dry (4/2/5Y5)
A_3	6 or 10 - 14 or 16"	Dark slightly reddish-brown coarse sandy clay loam; friable. Reddish-brown when dry.
B_2	14 or 16 - 17 or 32"	Reddish-brown coarse sandy clay loam with some dark streaks in spots; contains imbedded granitic boulders. Reddish-yellow when dry.
C	Below 17 or 32"	Reddish-brown gritty clay mottled with yellow and red. The very margin of weathered imbedded boulders is dark reddish-brown. Mainly pink when dry.

Then gradually one goes down into very irregularly weathered rotten granite and imbedded granitic boulders.

Near the base of this same slope I find the following:

A_1	0 - 7"	Jet black granular sandy clay loam.
A_3	7 - 12"	Very dark brown sandy clay loam
B_1	12 - 17"	Transitional
B_2	17 - 41"	Reddish-brown, somewhat sandy clay; firm but friable.
B_3	41 - 50" plus	Red to reddish-brown coarse sandy clay; quite firm.

This soil is on a slope of about 5 percent and a few yards farther down is a strip of gallery forest.

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A_1	0 - 7"	Jet black granular sandy clay loam.
A_3	7 - 12"	Very dark brown sandy clay loam
B_1	12 - 17"	Transitional
B_2	17 - 47"	Reddish-brown, somewhat sandy clay; firm but friable.
B_3	47 - 50" plus	Red to reddish-brown coarse sandy clay; quite firm.

This soil is on a slope of about 5 percent and a few yards farther down is a strip of gallery forest.

On the smooth upland I look at another profile under fallow with several native woody legumes -- Crotolaria Agathiflora, Sesbania (sp), and Cassia didymosotria. This land was plowed five years ago.

A_P	0 - 8"	Very dark brown to black; firm but easily friable granular clay loam
A_3	8 - 12"	Brown sandy clay loam. The soil is firm -- I think from some tendency to a plow sole.
B_1	12 - 15"	Transitional
B_2	15 - 38"	Red clay; firm but easily friable to soft small rounded nut
B_{30}	38 - 60"	Dark red friable clay with some dark brown streaks
B_{31} or C	60 - 70" plus	Like above but with some mottling with orange-red.

I see another soil like this in the coffee planting. The profile is dug through an old tree pit. This pit is some 24 inches deep and 20 inches wide. When the trees were planted the pit was filled with black surface soil. Although the B seems friable, only a very few roots of this coffee tree have left the pit to penetrate the red clay. Although they use coffee hulls and a good deal of farm manure around these trees, the yields are not satisfactory./a

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/a The coffee is grown under the shade of Albizzia stipulata.

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[a] The coffee is grown under the shade of Albizzia stipulata.

I also see some cinchona, sisal, and vitiver for perfume. I see a little dam on the stream built 13 years ago by Director Jurion in order to impound water for a little mill to grind coffee and so on.

We are back to lunch at 1:30. The effects of the quinine have about disappeared. We have lunch with the Director of the station, M. Rossignol, and the veterinarian advisor, M. Gillain.

Meals in the Congo take quite a long time because the boy serves in order according to protocol. Then in the same order he offers seconds of each course. The dishes are taken off and new ones added. All this goes on in order of protocol through several courses with very few if any words spoken to him or by him.

After lunch I look at a large group of plots of established grasses. There are a great many various kinds of grasses grown in little plots under experimental conditions of establishment and grazing.

In addition there is a very large garden of grass collections -- about 97 kinds. Each kind is in three small plots with brick guards: One plot is for seed, one to clip, and one to observe. There is another set of plots for studying adaptability. These are cut. A cow is turned into the plots while a botanist observes her preferences. Then the next day another

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K-1401 June 11, 1947 Belgian Congo
Near Nioka in village of Mutchapa. Native strip-cropping on slope of about 7 to 12 percent of "black-red" soil from granite. Maize, beans, cassava, Eleusine, and a few potatoes. Each strip cropped about 3 years. Now has third crop after 1½ years cultivation. Next cassava will be planted and then natural fallow will follow.

K-1402 June 11, 1947
Near Nioka. Main street in village of Mutchapa. (Trees were planted.)

K-1102. June 11, 1947. Belgian Congo
Near Nioka in village of Mutchapa. Native
strip-cropping on slope of about 7 to 12 percent
of "black-red" soil from granite. Maize, beans,
cassava, Elausine, and a few potatoes. Each strip
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K-1102 June 11, 1947
Near Nioka. Main street in village of Mutchapa.
(Trees were planted.)

cow is used, and so on. The production of these plots is measured by clipping. There are four replications for each grass.

I look at some native strip-cropping in a native village near Nioka. They have maize and beans growing together, cassava, Eleusine, and a few Irish potatoes. They plan on about one-fifth hectare per person but the fields are laid out on a community basis. Each cropped strip is in crops for about three years. The land now has the third crop after one and one-half years of cultivation. Next they will plant cassava and let this field go to natural fallow. It has a slope of 7 to 12 percent with terraces.

Elsewhere the village has bananas growing in the very bottom of gullies where there are gallery forests.

I see a Half-Bog soil on a young alluvial terrace developed under papyrus and some large carex. Part of the area is drained and a European farmer is growing some vegetables. These are only fair. The surface soil is patchy -- muck and mucky fine sandy loam -- underlain by a heavy gray clay, streaked with brown, which overlies the granitic alluvium.

In this area fields are ordinarily laid out more or less helter-skelter but usually with the long way, and the rows, up and down the slope. Fortunately most fields are small. On slopes over 3 or 4 percent this black-red soil from granite

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erodes badly with long cultivation. The natives are being encouraged to use terraces and run the rows approximately on the contour.

Here I do not see much erosion except where the cattle collect near headquarters and in a few places near the villages. But certainly erosion is a serious hazard considering the increasing population.

In a broad sense this black-red soil from granite probably belongs to some zonal type -- perhaps one not yet named -- but it has many local types and phases related to differences in lithological composition and especially to the geomorphological history of the individual landscape.

I get my pants from the native tailor and go to dinner at the Hotel de Nioka. Then early to bed.

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I get my pants from the native tailor and go to dinner at the Hotel de Nioka. Then early to bed.

June 12: Nioka to Butembo

We are up at dawn and have an early breakfast. As we go west of Nioka the soil seems somewhat better, with more gallery forests. The banana plants look better. It is quite probable that there are more basic minerals in the granite. Along our road there are mostly native farmers but south of the river there are many European farmers. The country looks good and there seems to be plenty of land. INÉAC plans to give more attention to forest here because the market is good and there is no forest for a long distance.

Nineteen kilometers west of Nioka we come to a cinchona plantation of INÉAC. Here the elevation is approximately 5700 feet and the rainfall approximately 58.5 inches. There are now 69 hectares planted and they expect to have 100 in all. The work was started in 1932 but most of the planting was done in 1939. The trees are set out 1 meter by 1 meter. In three or four years the first thinning of branches is made. A little later the weaker plants are removed; that is, the whole plant is taken out, roots and all. At 15 to 17 years they take out all the plants and begin again. This area is just on the eastern edge of a small forest area that extends some 15 kilometers to the west -- the forest area I noted from the plane east of Irumu.

A little later INÉAC will experiment here with tea.

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A little later INEAC will experiment here with tea.

K-1403 June 12, 1947
Belgian Congo. About 19 kilometers west of Nioka on INÉAC Cinchona planting. Young plantings in foreground; nursery in center; food crops of native workers in center background; some original forest in right and left background.

K-1403 June 12, 1947
Belgian Congo. About 19 kilometers west of Niuka on INEAC Cinchona plantation. Young plantings in foreground; nursery in center; food crops of native workers in center background; some original forest in right and left background.

Director Jurion tells me how he was nearly killed by spears in an elephant trap when exploring this site.

I look at the soil under a cinchona planting made in 1932. The soil is very deep over the hard rock. It occurs on a slope of about 4 percent just a little below the top of a rounded hill. The soil was irregularly cultivated before the plantings were made. It had previously been in forest.

Soil Profile Sample No. 22

A_p	0 - 8"(5-12")	Dark reddish-brown granular clay loam. Reddish-brown when dry.
A_3	8 - 15"	Reddish-brown granular to fine nut clay loam. Light reddish-brown when dry.
B_1	15 - 32"	Red to reddish-brown granular friable clay loam. Yellowish-red when dry.
B_2	32 - 52"	Dark reddish-brown softly granular clay loam. Reddish-brown when dry.
B_3	52 - 70"	Transitional; slightly lighter in color.
C	70 - 85" plus	Red softly granular clay with faint evidence of small concretions. Reddish-yellow when dry.

Roots of trees penetrate the whole soil easily at 72 inches. This is a <u>beautiful</u> soil, perhaps the "prettiest" one I have ever seen.

On another hill I see lateritic gravels and an exposure of lateritic hardpan at least 2 or 3 feet in thickness. Near this exposure a shallow pit has been prepared in a young cinchona planting.

Director Durion tells me how he was nearly killed by a python in an elephant trap when exploring this site.

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Table 5. Analyses of Red Latosol. (22)

Sample No.	Horizon	Depth	pH	Organic ~~Matter~~ Carbon	Size Class and Diameter of Particles (*in mm.*)							Other Classes (*in mm.*)		
					Very coarse sand 2–1	Coarse sand, 1–0.5	Medium sand, 0.5–0.25	Fine sand, 0.25–0.1	Very fine sand, 0.1–0.05	Silt, 0.05–0.002	Clay, <0.002	0.02–0.002	<0.005	>2
		Inches		*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
48727	A_p	0–8	6.6	2.8	9.5	13.9	6.3	7.4	2.3	11.9	48.7	10.4	54.4	0
728	A_3	8–15	4.4	1.8	11.6	12.1	5.5	6.8	2.1	10.5	51.4	9.4	56.1	0
729	B_1	15–32	4.2	0.8	10.1	10.6	5.0	6.6	2.1	10.6	55.0	9.4	59.9	0
730	B_2	32–52	4.4	1.0	12.9	10.2	4.9	7.0	2.0	9.1	53.9	8.0	57.9	0
731	B_3	52–70	4.5	0.8	9.2	9.4	4.6	6.8	2.3	10.7	57.0	9.4	61.7	0
732	C	70–85	4.4	0.3	8.8	8.7	3.8	5.4	2.0	12.0	59.3	11.3	64.7	0

Sample No.	Horizon	Depth	Exchangeable Cations me/100 g					Sum of Cations me/100 g	% Base Saturation	Thermal Analysis Data Particle Size Analyzed	Minerals Present Kaolinite ~~Type~~	Hydrous oxides*
			Ca	Mg	Mn	K	H					
											Pct.	*Pct.*
48727	A_p	0–8	13.4	1.5	0.02	0.7	9.0	24.6	63	<50μ	60	1
728	A_3	8–15	1.4	0.7	0.04	0.4	18.1	20.6	12			
729	B_1	15–32	0.5	0.6	0.02	0.4	13.9	15.4	10			
730	B_2	32–52	0.1	0.4	<0.01	1.1	18.5	20.1	8	<50μ	65	1
731	B_3	52–70	0.1	0.4	<0.01	1.2	14.2	15.9	11			
732	C	70–85	0.1	0.2	<0.01	0.5	9.3	10.1	8	<50μ	70	3

*Presumably Gibbsite

Congo Soil Profile No. 22

U. S. GOVERNMENT PRINTING OFFICE 16—46512-2

Congo Soil Profile No. 28.

Size Class and Diameter of Particles (in mm.)

Sample No.	Horizon	Depth	pH	Organic Carbon	Very coarse sand 2–1	Coarse sand 1–0.5	Medium sand 0.5–0.25	Fine sand 0.25–0.1	Very fine sand 0.1–0.05	Silt 0.05–0.002	Clay <0.002	Other Classes (in mm.) 0.002–0.0	>2.0	<2
4878	A	0–8	6.6	2.3	9.5	13.9	6.3	4.7	2.3	11.9	49.4	10.4	2.4	0
4879	B	8–15	4.4	1.8	11.3	10.6	5.2	3.8	1.5	10.2	45.2	9.4	1.2	0
4880	B	15–25	4.5	0.8	10.1	10.3	5.0	3.0	2.0	10.5	52.0	3.6	3.2	0
4881	B	25–70	4.4	0.4	9.5	8.6	4.6	2.7	2.2	10.7	57.0	4.8	1.8	0
4882	C	70–85	4.4	0.2	8.8	7.7	3.8	2.4	2.2	10.8	58.2	2.8	1.7	0

Thermal Analysis Data

Particle Size Mechanical Analysis Data

Mineral Fraction

Organic Matter-free Basis

Sum of Fractions Base Saturation

Sample No.	Horizon	Depth	Ca	Mg	K	Na	H	Total Exchangeable Cations m.e./100 g.	Base Saturation %	Fine Clay <0.0002	Medium Clay 0.0002–0.0006	Coarse Clay 0.0006–0.002	Fine Silt 0.002–0.006	Medium Silt 0.006–0.02	Coarse Silt 0.02–0.06	Very coarse Silt 0.06–0.2	Fine Sand 0.2–0.6	Medium Sand 0.6–2.0	Coarse Sand 2.0–6.0	Very coarse Sand 6.0–20.0	Gravel >20.0 mm.	Structure*
4878	A	0–8	0.5	0.1	0.05	0.03	4.4	5.1	14	49.7	10.4	3.4	1.3	1.2	0.9	0.5	0.4	0.4	0.4	0.4	0	
4879	B	8–15	0.2	0.1	0.04	0.03	4.4	4.8	8	45.2	9.4	3.4	1.2	1.1	0.8	0.5	0.4	0.4	0.4	0.4	0	
4880	B	15–25	0.2	0.1	0.03	0.03	4.5	4.9	8	52.0	3.6	3.2	2.5	2.3	1.8	1.0	0.8	0.8	0.8	0.8	0	
4881	B	25–70	0.2	0.1	0.03	0.03	4.4	4.8	8	57.0	4.8	1.8	2.5	2.3	1.8	1.0	0.8	0.8	0.8	0.8	0	
4882	C	70–85	0.2	0.1	0.03	0.03	4.4	4.8	8	58.2	2.8	1.7	2.5	2.3	1.8	1.0	0.8	0.8	0.8	0.8	0	

*Structure Symbols

%	1	2	3
	<50%	50%	>50%

U. S. GOVERNMENT PRINTING OFFICE 16—49213-3

Soil Profile Sample No. 23

A_P	0 - 8"(6-12")	Dark brown granular clay loam. Reddish-brown when dry.
A_3	8 - 20"	Reddish-brown clay; firm, but easily friable to granular. Yellowish-red clay.
B_2	20 - 42"	Red to dark red clay; easily friable to granular. Reddish-yellow when dry.
B_3	42 - 60" plus	Red gravelly (concretionary) clay loam. Compact in place but easily friable when reworked.

In an old road cut nearby the lateritic hardpan is exposed under a shallow solum of about 2 feet and a dark red layer of lateritic gravel for 10 feet. I crack out a sample from this massive lateritic hardpan as the C_C of profile No. 23.

Director Jurion explains that it is a difficult problem to raise the cinchona seedlings since they need to have proper humidity, soil, water, and light. They are grown here under thatched sheds open on one side. They are transplanted once in the nursery. Eight months elapse from the planting of the seeds to the first transplanting and the little seedlings spend one year more in the nursery. I see the natives here making shade screens for the nurseries out of the stems of the papyrus. It is a lot of work for the natives to carry water in big cans on the head to water these seedlings.

After planting out in the field some hoeing is required, but in four or five years their own shade keeps out most of the grass.

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After planting out in the field some hoeing is required, but in four or five years their own shade keeps out most of the grass.

At 9:45 we go on towards Irumu/a, for awhile on rolling red soil under the forest. I see no lateritic hardpan even in deep cuts. When cleared the trees come back here only very slowly. In a little way we pass a rather large private cinchona plantation. The forest is dense but much less so than at Yangambi. It contains a high percentage of vines. A large proportion of the land near the road is used for cassava, maize, and other food crops. Within the area, many of the first bottoms have a cover of papyrus and carex.

We pass Djugu, a large native center, and now find ourselves out of the forest except for a few narrow galleries. We are back on the black-red soil from granite. The surface is rolling and has many big granitic boulders. The rock is coarse-grained and rich in biotite. On the whole, the soil is heavily cropped.

Most of the villages here are along the road as required by the medical service; but this is not so good from the agricultural point of view as scattered villages. The medical service encourages the natives to build their houses with walls 4 to 6 feet high in contrast to the old type in which the thatched roof goes all the way down to the ground. In these types the rats are very numerous and tend to spread disease. Most people along here wear at least some cloth garments.

/a The elevation is somewhat under 5,000 feet and the rainfall about 68 inches.

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[a] The elevation is somewhat under 5,000 feet and the rainfall about 68 inches.

Beyond Djugu for some distance the soil has a somewhat less intense red color than the profiles last described although some of it is quite red. A great deal of the soil is strongly rolling to hilly and consists mainly of heavy clay from diorite. This is apparently a productive soil for crops. The soil has a black A_1 horizon about 6 to 10 inches deep. Some slopes are cultivated up to 70 percent.

We continue on a very winding road in strongly rolling country. About 32 kilometers beyond Djugu we pass Jina, a gold mining center. Here there is also strongly rolling to hilly red soil from diorite with a black A_1 horizon about 5 to 8 inches thick. The smoother and better areas are in native food crops but much of the land is nearly open savanna.

We are now in the area of the Mambisa tribe. About 12 kilometers above Jina, we pass Tsi Mountain, formerly worked for gold. We find the same strongly rolling to hilly soil near Nizi, another gold mining center with an elevation of 1250 meters.

Twenty-six kilometers beyond Jina we enter the area of the Babira tribe. In the old days the women of this tribe had the very large deformed lips but now only very old women are to be seen with these deformations.

The black-red soil from diorite is gently rolling, strongly rolling, and hilly. Beneath the black A_1 some of the soils are a strong red and some of them are an orange-red.

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A fairly high proportion is in native food crops which seem to be doing well. These include maize, bananas, cassava, and a few ordinary vegetables.

About 5 kilometers from Bunia granite is again plentiful. We pass Bunia at 11:30. This town is rather new and looks a good bit like a small trading town in western United States. Just beyond, we pass a very large farm -- the Dele farm -- where food crops are raised for a gold mining company. They have cassava and excellent maize. When they first started out their maize crops ran 5 tons to the hectare but much of this land had to be returned to pasture partly because of erosion in the sloping places and partly because of a decline in yield. It is a very good thing that clean cultivation for more than 3 or 4 years is not economically practicable on these soils from granite; otherwise erosion would be severe.

All along these main roads there are large crews working on the highways. This is partly in anticipation perhaps of the coming visit of the Prince Regent. Most of the work is done with very simple tools. The earth is moved mostly in baskets carried on the head, although I have seen a few wheelbarrows.

Along here I see some hills with good pasture. The main grass is Themeda. The surface A_1 is black sandy loam or loam about 12 inches deep over red or orange-red soil from granite.

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K-1519 June 12, 1947
Belgian Congo. East of Irumu. Profile of normal soil for this region on granite.

K-1519 June 12, 1947
Belgian Congo. East of Irumu. Profile of abnormal soil for this region on granite.

The C of rotten coarse granite is reached at 4 to 6 feet and is penetrated with nearly black streaks and tongues of the B_3. Here the land is gently rolling with some undulating spots that are used for good food crops. On the seepy slopes there are horizons of gray between the A_1 and the C but normally the upper B is reddish-brown and the lower B somewhat mottled with orange-red. The area is not uniformly granite; there are some intrusions of basic rocks.

This undulating to gently rolling plain continues for a long way. Large parts of it are quite open and treeless with savanna grasses about 2 to 3 feet high for the most part. As we approach Irumu there are more people on the road. Near all such cities the women wear gay dresses with large designs in strong dark colors. We reach Irumu about 12:50. For the last 2 or 3 kilometers into the city the soil is rather thin over schist.

After lunch in Irumu we start south towards Butembo. The soil is rather thin and has a dark A_1 horizon over yellowish-brown and orange-red soil from schist. The food crops on the stream terraces and lower slopes look good.

At 5 kilometers we are back on the gently rolling black-red soil from granite. Here much of the land is used for food crops partly because it is so close to the city. The remainder is fairly open savanna with a few forest galleries. I wonder

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again why there are only a few small termite mounds on these black-red soils from granite.

At 20 kilometers the grasses are taller, there are more low trees, and more gallery forest. Then at 25 kilometers the forest begins. I now see good plantings of bananas, cassava, and some papaya. There are areas here of yellowish-brown soil from diorite. This good soil continues for quite a little ways and many well-cultivated fields contain bananas, cassava, and maize growing together. There are a few little plantings of oil palms.

Just as we leave the area of the Babira tribe I see one old woman along the road with the great big lips. Then we pass into the area of the Walese tribe.

At 46 kilometers we are in gently to strongly rolling dark reddish-brown soil from granite developed under heavy forest. Here I see some good bananas, maize, and cassava. Unfortunately the elevation here is too great for the umbrella trees which are such excellent soil restorers. Along here we stop to take some pictures of the Pygmies (Basua tribe?). These little people are quite primitive indeed. They are mostly hunters and go deep into the forest for game. Some of this meat they exchange with other natives for bananas, maize, and other food crops.

Although we still continue to see excellent food crops

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K-1404 June 12, 1947
Belgian Congo. About 56 kilometers south of Irumu. Excellent management of reddish-brown ~~lateritic~~ Latosol soil from granite, showing bananas and cassava together, with forest just returning at the end of the cropping period. Some trees had been left for regeneration.

K-1520 June 12, 1947
Belgian Congo. 60 kilometers south of Irumu.
Pygmies.

K-1404 June 12, 1947
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Excellent management of reddish-brown lateritic
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K-1520 June 12, 1947
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on the reddish-brown soil from granite, this soil is likely a little less productive than the associated soils developed from the diorite. This is certainly a beautiful country with the dense forests, bananas, red soil, and now and then, a dash of scarlet cannas.

Eighty kilometers from Irumu we are in gently rolling land developed from diorite and quartz-diorite under the forest. Actually, most of the soil is developed on local colluvium and alluvium. The soils are rather heavy and somewhat stony. Some are orange-red, some red, and some yellowish-brown.

On the big trees here in the forest there is Spanish moss. At 90 kilometers from Irumu, just before entering the Costermansville province, there are areas of excellent food crops. We pass Eringite, a small village. The good forest and mixed food crops continue. Although it was hot in Irumu we are now getting into high country where it is cool. We pass Kisiki where conditions are about the same except that the forest is declining a bit and grass is coming into the fallows.

We now enter the area of the Banade (?) tribe, about 31 kilometers north of Beni. About 22 kilometers north of Beni there are a good many native oil palms as well as food crops. But in this higher land the grass is quite bad.

Most women on the highway along here wear some clothes, but some of the very old women and the well-formed young ones wear very little indeed.

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(a)

(b)

(c)

Pygmies. (a) With Director Jurion, (b) with me, (c) a family group. Photos by Jurion.

(a) (b)

(c)

Pygmies. (a) With Director Durlon; (b) with me;
(c) a family group. Photos by Durlon.

Fifteen kilometers north of Beni there is again quite a bit of oil palm. There is lots of grass and few trees except in the galleries. The maize and the bananas are not very good. Five kilometers north of Beni the savanna is again dominant. The black A_1 is about 5 to 8 inches thick. The cultivated soil is a dark brown sandy loam. The parent rock is granite. On this black-red soil from granite the food crops are only fair and there is mostly grass in the fallows. We are soon climbing into strongly rolling hills. I see only a few small bananas, many of which I am told are used for making beer. In this rolling savanna the grasses are tall. The natives here produce no cattle, partly because of the sleeping sickness. But a few European farmers are having some success. This area is said to have many elephants. There are patches of food crops on the better sites in the coves and along the drainageways.

About 12 kilometers south of Beni we are in granite mountains and then a little ways farther we are in diorite country. There are good forest galleries in the savanna. They still have bananas, cassava, maize, sweet potatoes, a little grain sorghum, and quite a bit of taro. At 21 kilometers south of Beni we pass a European ranch with some fair cattle. We then enter a deep mountain valley with dark red soil from diorite. The soils are quite intensively cultivated and the forest is disappearing. Here there is also quite a bit of savanna in the fallow.

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At 30 kilometers south of Beni there are bold hills covered mostly with savanna and with gallery forests. Food crops are planted here on quite steep slopes. Since the patches are small and irregular, there isn't much erosion. The numerous field boundaries act as terraces but there is a significant erosion hazard if the intensity of cropping should increase. In places the soil is a very deep red, in other places dark red, and in some orange-red, depending upon the moisture conditions. In addition to food crops there are some plantings of arabica coffee and of tung trees. This is said to be also a good soil for tea and cinchona. I collect a sample of the deep B and of the rock. The depth of the soil over the rock is extremely irregular.

We reach Butembo at 6:10 p.m. -- almost dark. Coming into town we see several new nice looking homes. Here we each have a nice small brick house with parlor, bedroom, and bath (and electric lights).

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June 13: Butembo to Ruindi (Cross the Equator)

As we start out this morning, Director Jurion tells me that excellent yields of potatoes, with European varieties, are obtained here. I am a little surprised that they do so well here with the short days in view of some of the reports I have heard of poor yields of United States varieties in South America near the Equator.

He also points out that Professor Baeyens' approach to the problems of soil fertility were quite theoretical, perhaps necessarily so in the beginning. But many of his theoretical suggestions have not been borne out by recent experiments. For example, in the low Congo he insisted on the need of irrigating bananas on alluvial soils. But recent results show clearly that the yields can be maintained with compost and mulch without irrigation. I hope to be able to see those experiments./a

Going south from Butembo we come almost at once into large plantings of bananas and some of coffee and bananas together. There is also taro on both wet and well-drained areas. The red strongly rolling soils are developed from diorite, schist, and granite. There is a heavy population on these good soils and they are heavily cropped. In many places the bananas are thinned, and beans, taro, maize, cassava, and Eleusine grown

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/a Added later: These experiments are described in this Journal for July 2 and 3.

June 13: Butembo to Ruindi (Cross the Equator)

As we start out this morning, Director Jurion tells me that excellent yields of potatoes, with European varieties, are obtained here. I am a little surprised that they do so well here with the short days in view of some of the reports I have heard of poor yields of United States varieties in South America near the Equator.

He also points out that Professor Baeyens' approach to the problems of soil fertility were quite theoretical, perhaps necessarily so in the beginning. But many of his theoretical suggestions have not been borne out by recent experiments. For example, in the low Congo he instated on the need of irrigating bananas on alluvial soils. But recent results show clearly that the yields can be maintained with compost and mulch without irrigation. I hope to be able to see those experiments.[a]

Going south from Butembo we come almost at once into large plantings of bananas and some of coffee and bananas together. There is also taro on both wet and well-drained areas. The red strongly rolling soils are developed from diorite, schist, and granite. There is a heavy population on these good soils and they are heavily cropped. In many places the bananas are thinned, and beans, taro, maize, cassava, and Elevatine grown

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[a] Added later: These experiments are described in this Journal for July 2 and 3.

K-1405 June 13, 1947
Belgian Congo. About 15 kilometers south of Butembo. Native terraces on strongly rolling reddish-brown lateritic soil from diorite. Mostly beans growing now.

K-1406 June 13, 1947 Belgian Congo
About 16 kilometers south of Butembo. Native terracing (after instruction from agricultural advisors) on strongly rolling reddish-brown lateritic soil from diorite. Mostly beans planted with some potatoes and bananas.

K-1405 June 13, 1947
Belgian Congo. About 15 kilometers south of
Butembo. Native terraces on strongly rolling
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About 16 kilometers south of Butembo. Native
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advisors) on strongly rolling reddish-brown
lateritic soil from diorite. Mostly beans
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with them. This is a good method here because bananas protect the soil from erosion and provide shade. Some plantings go up to slopes of 70 percent and more. There are some poor terraces. Fortunately the little fields are so small that the pattern gives a partial effect of strip-cropping. Here the banana plant serves as the fallow crop. Strips are opened in the bananas for two years' cultivation and then the soil goes back to bananas.

The road through these mountains is very winding but well made. The geology is quite complicated. Erosion is not so great as might be expected because most rains are gentle, the soils are porous and absorb water rapidly, and the fields are small and patchy.

In some places I see Irish potatoes and taro grown together as a mixture!

The day is cloudy, cool, and a little hazy.

I see quite a few nice pigs along the road. Most of the natives here wear goat skin mantles.

Here in the mountains wheat is grown, often on slopes up to 70 percent. Unless the land is carefully terraced they are likely to get erosion in wheat plantings. It is not considered a very good crop for this area. The variety grown is called Sabenero. We cross the Equator a little ways south of Lubwe. The crops here are wheat, Irish potatoes, taro,

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beans, bananas, and a little cassava. There are also some patches of pyrethrum. The elevation is about 2200 meters.

We go south into the area of the Bahuande tribe. In this high mountainous country there is a dense population. On the whole, good farming methods are followed for soil and water conservation, including strip-cropping and small terraces. I also see some cabbage, artichokes, squash, onions, cauliflower, and oats. But the crops are mainly wheat, taro, bananas, low beans and pole beans, and Irish potatoes. I see a few wool sheep but the animals are mostly pigs and goats. These natives obviously work hard and are good farmers.

I meet a native leading a pig. Probably he is on his way to see his fiancee.

About 16 kilometers north of Lubero in the high mountains, I look at a soil developed from either sandstone or a very highly weathered metamorphic rock. I shall call it a lithosolic Brown Forest. The surface 2 to 5 inches is a dark brown fine sandy loam or loam over the rotten rock. The loose material on all the slopes is colluvial. Except for a few hard igneous rocks, all the rocks here are weathered to great depths. In the highest part of the mountains there is more forest with cropping confined largely to the small coves. But as we descend again, say about 10 kilometers north of Lubero, the amount of cropping increases. I stop to take a picture in

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color of beautiful reticulate mottling of yellow and red in weathering sandstone under the Brown Forest soil.

Here again the crops include pyrethrum, taro, bananas, maize, and beans. Although there are not many cattle, I see some Fresian cows on improved pasture. As we come into Lubero, we drive along a small imperfectly drained alluvial valley with taro and maize grown separately and in mixtures. Other crops are on the sloping land to the side. We pass a flour mill and a sausage factory.

The elevation at Lubero is about 1900 meters. This is an important native market and trading center. South of the village we climb into the mountains again. Cultivation is not quite so intensive as before, although I see one long steep slope all in cultivated crops, and with some erosion. Here the natives are still following the old methods and have not modified their field layouts to provide strips and terraces in accordance with the suggestions of the agricultural advisors.

About 6 kilometers south of Lubero, we pass one of the few good examples of forest with tree ferns. There is some Spanish moss on the large trees as well. Most of the cleared land has a high proportion of savanna in the fallows. Some exceedingly steep slopes are cultivated. We pass a European plantation of pyrethrum on slopes of 40 to 80 percent without proper barrier strips. There is active erosion in these fields.

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K-1521 June 13, 1947
Belgian Congo. 6 kilometers south of Lubero.
View of forest in high mountains.

View of small village and food crops near
Lubero. (Photo by Jurion.)

K-1521 June 13, 1917
Belgian Congo. 6 kilometers south of Lubero.
View of forest in high mountains.

View of small village and food crops near Lubero. (Photo by Turion.)

Director Jurion regards such pyrethrum plantations on strong slopes as "a white man's folly".

The men one sees along the road in the Congo wear an odd assortment of clothes falling into three main classes: (1) The native costumes, (2) left-over clothes of the Europeans, and (3) copies of European clothes. An individual may have the pants from one class and the shirt from another, or possibly a coat or vest from one and the other garments from the others. And any of the garments may be in any stage of decomposition.

It is too bad that so much of this forest is being cleared. Now there is a large amount of bamboo in the forest. We pass several plantings of pyrethrum on steep slopes and in wet alluvial bottoms having deep narrow drainage ditches. The future of this pyrethrum enterprise is very uncertain on account of the effect of DDT upon demand and price. Right now the price is going down. I see a few nice pastures with Kikuyu grass following pyrethrum. In this very high area there are only a few bananas. We pass another "pyrethrum folly" on very steep slopes. But the forest still predominates in this high rugged area north of Alimbongo. After clearing, the forest here returns very slowly if indeed at all. It is rather a pity that clearing is now going ahead so fast.

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Director Jurion regards such pyrethrum plantations on strong

mountains about 2 kilometers south of Alimbongo on a steep slope of about 20 percent under a heavy forest.

Soil Profile Sample No. 24

A_{00}	3½ - 3"	Fresh leaves and twigs.
A_0	3 - 0"	Brown mat of roots and leaf mold of variable thickness; quite loose. Dark reddish-brown when dry.
A_1	0 - 5"	Loose easily friable dark reddish-brown very fine sandy loam; many fine roots. To light reddish-brown when dry.
A_3	5 - 20"	Dark reddish-brown with some purple tint, heavy loam. A little more firm than A_1 and easily friable to fine crumb. Reddish-brown when dry.
B_2	20-50"	Reddish-brown to dark reddish-brown, with purple tint, fine sandy loam. Slightly firm; easily friable poor irregular nut structure. Reddish-brown when dry.
B_3	50 - 60"	Dark reddish-brown gravelly clay loam (thicker in some places). Purplish-gray when dry.
C	60 - 70" plus	Dark purplish and pinkish-brown rotten schist. Pink when dry.
D	8 - 10 feet	Schist.

There are many variations in the depth, texture, color, thickness, and clay content of B_3 and C. Roots penetrate well into C.

In these mountains are other soils from different rocks with the same general profile but with yellowish-brown, red, and orange-red colors.

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In these mountains are other soils from different rocks with the same general profile but with yellowish-brown, red, and orange-red colors.

Table 27. Analyses of Latosolic Brown Podzolic. (24)

Sample No.	Horizon	Depth	pH	Organic ~~Matter~~ Carbon	Size Class and Diameter of Particles (*in mm.*)							Other Classes (*in mm.*)		
					Very course sand 2–1	Coarse sand, 1–0.5	Medium sand, 0.5–0.25	Fine sand, 0.25–0.1	Very fine sand, 0.1–0.05	Silt, 0.05–0.002	Clay, <0.002	0.02–0.002	<0.005	>2
		Inches		*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
48740	A_1	0–5	4.2	5.8	2.2	7.9	7.4	15.5	7.8	15.8	43.4	10.8	47.7	0
741	A_3	5–20	4.3	3.6	2.4	9.0	8.0	16.8	7.9	14.9	41.0	10.2	45.1	0
742	B_2	20–50	4.1	1.6	1.6	7.5	7.3	16.0	8.1	15.3	44.2	10.4	48.1	0
743	B_3	50–60	4.4	---	9.3	12.2	9.1	17.8	8.5	15.3	27.8	10.2	31.5	0
744	C	60–70+	4.6	0.2	12.3	18.9	9.4	15.5	7.3	19.9	16.7	14.4	21.4	0

Sample No.	Horizon	Depth	Exchangeable Cations me/100 g					Sum of Cations	% Base Saturation	Total P	Available P
			Ca	Mg	Mn	K	H	me/100 g		%	p.p.m.
48740	A_1	0–5	0.1	0.3	0.01	0.4	12.4	13.2	6	.010	13
741	A_3	5–20	0.1	0.2	<0.01	0.2	23.3	23.8	2	.052	--
742	B_2	20–50	0.1	0.1	<0.01	0.1	18.7	19.0	2	.046	6
743	B_3	50–60	0.1	0.1	0.01	0.2	11.5	11.9	3		
744	C	60–70+	0.2	<0.1	<0.01	<0.1	4.1	4.3	5	.024	0

Congo Soil Profile No. 24

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Congo Soil Profile No. 24

Sample No.	Horizon	Depth	Very coarse sand 2-1 mm.	Coarse sand 1-0.5 mm.	Medium sand 0.5-0.25 mm.	Fine sand 0.25-0.1 mm.	Very fine sand 0.1-0.05 mm.	Silt 0.05-0.002 mm.	Clay <0.002 mm.	Total <2 mm.	Organic matter	Total N	C/N	pH
		cm.	%	%	%	%	%	%	%	%	%	%		
47740	A1	0-5	3.2	1.3	4.4	15.3	8.7	18.8	48.3	100.0	2.28	0.132	17	4.7
47741	A3	5-20	2.8	0.8	3.0	12.8	7.1	14.2	59.3	100.0	0.92	0.060	15	4.8
47742	B21	20-50	1.9	0.7	2.7	11.8	6.8	13.2	62.9	100.0	0.52	0.040	13	4.8
47743	B22	50-90	1.8	0.7	2.7	11.7	6.8	13.2	63.1	100.0	0.39	0.035	11	4.8
47744	B3	90-150	1.8	0.7	2.7	11.8	6.8	13.2	63.0	100.0	0.31	0.030	10	4.8
47745	C	150+	1.8	0.7	2.7	11.8	6.8	13.2	63.0	100.0	0.25	0.025	10	4.8

Available

	p.p.m.
	13
	2
	0

We continue on this winding mountain road with many horseshoe curves. Almost all the land is forested. In places we reach an elevation of 2300 meters.

Twenty kilometers south of Alimbongo I see a podzolic Lithosol on very steep slopes from weathered phylite.

A_1	0 - 5"	Nearly black gravelly fine sandy loam; loose.
A_2	5 - 10" (15-24")	Yellowish-brown gravelly stony fine sandy loam.
B_2	20 - 30"	(Irregular; some long tongues). Dark brown stony heavy fine sandy loam.
C	30 - 72"	Grayish, partially weathered phylite.

All the soil is loose and pervious. One doesn't find this kind of profile in the heavier textures.

We pass another plantation with clean cultivated pyrethrum on hilly soil like No. 24. There is some active erosion. This plantation is also growing geraniums for perfume.

We continue on a very winding road. At 35 kilometers I can look south over hilly land that is now quite open (deforested), with small trees, bushes, grass, and ferns. Here and there are cultivated strips of reddish-brown and orange-red soil, mainly from diorite. This area had considerable erosion, I think, many years ago and the soil now is stabilized by the savanna at a lower level of productivity than it was in the beginning under the forest. There is only a little cultivation

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except in small valleys, coves, and on some of the better slopes. There are not many people here. I see some maize, bananas, cassava, beans, and a few plantings of "blue" Eucalyptus for essential oil along with some more pyrethrum and geraniums. Mountains to the east are very rugged. At 70 kilometers we start a rapid descent through a rocky canyon. There are massive exposures of igneous and metamorphic rocks, mainly granite and schist. At the foot of the slope we pass into the Albert National Park south of Lake Edward. I can see Lake Edward as we come down the escarpment with the broad lake plain before it to the south.

It is a good deal warmer down here on the Ruindi plain than in the mountains. The rainfall here is about 35 inches and the elevation around 3300 feet.

As we come into the park I see buffalo and Thomas cob. There are many fine specimens of candelabra Euphorbias -- a sort of tree cactus. Probably this lake basin was formed in Pleistocene times. There are many thin deltas and stream terraces, but the area is generally flat where we enter the park.

We go to the park headquarters and, with the superintendent, drive back toward Lake Edward. I stop to look at a good columnar Solonetz that I noticed coming in. But I can see only the very surface. The vegetation is irregular with nearly barren spots characteristic of Solonetz where the salts have come into the soil by capillary action.

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A_1	0 - 1"	Dark gray slightly platy very fine sandy loam
A_2	1 - 5"	Yellowish-brown very fine sandy loam
B_2	5 - 10" plus	Dark brown hard columnar clay with columns 3 to 4 inches in diameter. There is some mottling with yellowish-brown and dark brown.

I take a sample of the column. Pale brown to brown when dry.

There are hundreds of thousands of acres of wild land here and it is not permitted to dig in the soil for one profile! I am told that to dig into the soil it would be necessary first to wire Brussels for permission! (Certainly there is no one place in the world that has a corner on bureaucracy. Since it is not permitted to dig in the park, one has to do a little more guessing than is ordinarily necessary.)

A little later I see some elephants on the Solonetz! We go north of the road near the west side of the lake plain on rather sandy Chestnut soils on alluvial fans. We see quite an area of chernozemic Wiesenboden with a nearly black surface of about 12 inches. This soil merges into Solonetz of the McKenzie type in the low places and into a complex of Solonetz and Reddish-Chestnut in the higher places. The dark soils have tall grasses, shrubs, and acacia trees, and the lighter soils have shorter grasses and Euphorbias.

Near Lake Edward there is a strong odor of sulphur in the air. It is swampy along the shore. I see hippopotami near the shore and some farther out in the lake.

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Near Lake Edward there is a strong odor of sulphur in the air. It is swampy along the shore. I see hippopotami near the shore and some farther out in the lake.

In another place I notice that the soil becomes lighter in color in depth with lime at about 24 inches. There are large areas of beautiful Solonetz here -- Solonetz right out of the book and only about one-half degree from the Equator!

We return to the camp and have our dinner in the central small house. We each sleep in a small individual hut made after the native style.

The young man in charge of this park, and the one at Gangala na Bodio, are certainly sincere and hard workers; yet they give the impression of being rather emotional conservationists who think of conservation mainly just for the sake of doing it.

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K-1407 June 14, 1947
Belgian Congo. 2 kilometers west of headquarters of Albert National Park.
Landscape of slightly solodized Solonetz.

K-1407 June 14, 1947
Belgian Congo. 2 kilometers west of
headquarters of Albert National Park.
Landscape of slightly solodized Solonetz.

Elephants in the savanna. (Photo by Jurion.)

Elephants in the savanna. (Photo by
Jurion.)

June 14: Ruindi to Goma

We are up just before daybreak in order to see the animals. During the night I could hear lions and hyenas far out in the savanna. On the way out into the park I see a good Reddish-Chestnut soil with "croûte calcaire" at 24 to 30 inches.

We see many animals quite close to us, including elephants, buffaloes, cobs, wild pigs, hippopotami, monkeys, and Egyptian geese.

We drive north of the road and near the Rutshuru River. The hippopotami are very thick and we see them lying along the shore of the river almost like cigarettes in a box. Many must weigh over a ton. The land is terribly overgrazed and bad erosion is beginning. At one time this soil certainly had a good cover because one can see it is Reddish-Chestnut and the erosion is in places exposing the characteristic "croûte calcaire". While near the river, we hear a lion roaring on the other side, but unfortunately we do not get a chance to see him. Here there are a few low termite mounds 1 to 2 feet high and 1 to 3 feet across.

It's a great pity that these soils are being so badly overgrazed. Fundamentally, the problem goes back to the emotional attitude toward the park. It is said that "the park must remain in its natural (sic) condition". This is ridiculous.

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We are up just before daybreak in order to see the animals. During the night I could hear lions and hyenas far out in the savanna. On the way out into the park I see a good Reddish-Chestnut soil with "croûte calcaire" at 24 to 30 inches.

We see many animals quite close to us, including elephants, buffaloes, coba, wild pigs, hippopotami, monkeys, and Egyptian geese.

We drive north of the road and near the Rutshuru River. The hippopotami are very thick and we see them lying along the shore of the river almost like cigarettes in a box. Many must weigh over a ton. The land is terribly overgrazed and bad erosion is beginning. At one time this soil certainly had a good cover because one can see it is Reddish-Chestnut and the erosion is in places exposing the characteristic "croûte calcaire". While near the river, we hear a lion roaring on the other side, but unfortunately we do not get a chance to see him. Here there are a few low termite mounds 1 to 2 feet high and 1 to 3 feet across.

It's a great pity that these soils are being so badly overgrazed. Fundamentally, the problem goes back to the emotional attitude toward the park. It is said that "the park must remain in its natural (sic) condition". This is ridiculous.

(a)

(b)

(c)

(d)

Hippopotomi in the Rutshuru River. (a,b, and c).
(d) Maroubouts near Lake Edward. (Photos by Jurion)

Hippopotomi in the Rutshuru River. (a, b, and c).
(d) Marouboute near Lake Edward. (Photos by Jurion)

As soon as one establishes the boundary of such a park he has immediately made an "unnatural" barrier. Although the natives are not animals, they are part of the fauna of the region. They have been removed from the park (except possibly for a few Pygmies that nobody could catch!) The natives are not allowed to burn the savanna; thus, some of the choice antelope seek pasture elsewhere and many of the lions go with them. The natives and the lions are the natural predators of the hippopotami. With the reduction in their predators, the hippopotami have multiplied enormously. Certainly the number of hippopotami in this park will be reduced. The rational way to do this is through a management program that reduces their numbers to the carrying capacity of their range. But if such a management program is not undertaken, the soil will continue to erode, with a further depletion of the pastures, and the numbers of hippopotami will be reduced through starvation. From what I see, I suspect the latter course will be followed and it will be a great pity because the park will be completely changed to an unnatural area with a great strip of bad lands where there shouldn't be any bad lands.

We drive over to Lake Edward to a fishing village. The natives use nets made from cotton cord which they get by unravelling the fabric of old automobile tires. The fish are cleaned, salted, and dried here. All around there are great crowds of huge birds -- Maroubouts -- that clean up the

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We drive over to Lake Edward to a fishing village. The natives use nets made from cotton cord which they get by unravelling the fabric of old automobile tires. The fish are cleaned, salted, and dried here. All around there are great crowds of huge birds -- Marabouts -- that clean up the

wastes. The natives live here in round mud huts with thatched roofs.

We get back from this trip well prepared for our breakfast.

Near the headquarters there is a fresh drainage ditch and I am able to get this deepened enough so that I may look at the soil. It is not too good a place and here I can find no evidence of "croûte calcaire". The soil is on a gentle slope of about 1 to 2 percent.

Soil Profile Sample No. 25

A_1	0 - 5	Very dark grayish-brown heavy fine sandy loam; very brittle now and dry, but crumbles to soft fine crumb; many grass roots. Dark reddish-brown when dry.
A_3 & B_1	5 - 10"	Dark reddish-brown fine sandy clay; hard when dry; irregular nut to granular; slight mottling with dark gray and brown. Reddish-brown when dry.
B_2	10 - 22"	Reddish-brown fine sandy clay; irregular nut to granular. Yellowish-red when dry.
B_{30}	22 - 31"	Very dark reddish-brown gravelly (concretionary) clay; hard in place; easily friable when removed. Brown when dry.
B_{31}	31 - 40"	Mottled yellow and brown gravelly clay. Brown and yellowish-red when dry.
C_C	40 - 44" plus	Hard concretionary crust but not continuously cemented.

The soil is mellow and softly granular to B_{30} when moist, but hard and brittle when dry. The slope here of 1 to 2 percent is a little more than normal in the area.

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We get back from this trip well prepared for our breakfast.

Near the headquarters there is a fresh drainage ditch and I am able to get this deepened enough so that I may look at the soil. It is not too good a place and here I can find no evidence of "croute calcaire". The soil is on a gentle slope of about 1 to 2 percent.

Soil Profile Sample No. 25

A_1 0 - 5	Very dark grayish-brown heavy fine sandy loam; very brittle now and dry, but crumbles to soft fine crumb; many grass roots. Dark reddish-brown when dry.
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B_2 10 - 22"	Reddish-brown fine sandy clay; irregular nut to granular. Yellowish-red when dry.
B_{30} 22 - 31"	Very dark reddish-brown gravelly (concretionary) clay; hard in place; easily friable when removed. Brown when dry.
B_{31} 31 - 40"	Mottled yellow and brown gravelly clay. Brown and yellowish-red when dry.
C_c 40 - 44" plus	Hard concretionary crust but not continuously cemented.

The soil is mellow and softly granular to B_{30} when moist, but hard and brittle when dry. The slope here of 1 to 2 percent is a little more than normal in the area.

Table 23. Analyses of Reddish ~~Chestnut~~ Prairie. (25)

Sample No.	Horizon	Depth	pH	Organic ~~Matter~~ Carbon	Size Class and Diameter of Particles (*in mm.*)							Other Classes (*in mm.*)		
					Very coarse sand 2–1	Coarse sand, 1–0.5	Medium sand, 0.5–0.25	Fine sand, 0.25–0.1	Very fine sand, 0.1–0.05	Silt, 0.05–0.002	Clay, <0.002	0.02–0.002	<0.005	>2
		Inches		*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
48746	A_1	0–5	6.0	1.3	1.4	5.1	10.1	33.9	17.6	12.3	19.6	3.5	20.4	0
747	A_3 & B_1	5–10	5.0	0.9	1.2	4.1	8.2	25.4	13.2	16.4	31.5	4.2	32.8	0
748	B_2	10–22	5.2	0.4	4.0	4.7	6.6	18.4	12.1	12.8	41.4	4.5	42.7	0
749	B_{30}	22–31	6.8	0.4	4.5	5.6	9.3	18.7	11.3	12.2	38.4	4.7	39.2	0
750	B_{31}	31–40	7.1	0.2	0.8	17.4	12.6	19.6	10.2	12.4	27.0	4.3	27.4	0
751	C_c	40–44+	7.0	0.1	2.2	3.3	8.8	35.2	14.4	16.8	19.3	5.6	20.1	0

Sample No.	Horizon	Depth	Exchangeable Cations me/100 g					Sum of Cations me/100 g	% Base Saturation
			Ca	Mg	Mn	K	H		
48746	A_1	0–5	2.4	2.2	0.05	0.7	5.8	11.2	48
747	A_3 & B_1	5–10	1.6	2.4	0.04	0.4	10.2	14.6	30
748	B_2	10–22	2.2	4.0	0.03	0.2	8.5	14.9	43
749	B_{30}	22–31	5.8	6.4	0.06	0.4	4.6	17.3	73
750	B_{31}	31–40	4.4	4.2	0.05	0.3	3.3	12.2	73
751	C_c	40–44+	3.4	2.7	0.18	0.2	3.9	10.4	62

~~Congo~~ Soil Profile No. 25

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Tongo Soil Profile No. 25

Sample No.	Horizon	Depth	pH	Organic Carbon	Very coarse sand 2–1	Coarse sand 1–0.5	Medium sand 0.5–0.25	Fine sand 0.25–0.1	Very fine sand 0.1–0.05	Silt 0.05–0.002	Clay <0.002	0.02–0.002	<0.002	<2
		Inches		Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
48746	A1	0–2	6.0	1.3	1.4	1.2	10.1	22.9	14.6	12.2	18.6	2.5	20.4	0
748	A3	2–10	5.2	0.9	1.5	1.4	8.5	25.4	14.8	12.4	21.2	4.2	25.8	0
749	B21	10–22	5.8	0.4	0.8	2.2	6.6	18.4	13.1	12.3	28.3	4.1	32.4	0
750	B22	22–40	6.1	0.3	0.8	2.2	8.3	18.6	13.3	12.4	28.3	4.3	32.6	0
751	C	40–44+	7.0	0.1	1.3	2.2	12.6	22.3	17.4	10.3	15.3	2.3	17.6	0

Exchangeable Cations m.e./100 g.

Ca	Mg	K	H	Sum of Cations m.e./100 g.	% Base Saturation
3.4	1.3	0.4	8.8	13.9	48
2.4	0.4	0.2	5.2	8.2	36
1.2	0.4	0.2	3.2	5.0	36
1.2	0.4	0.2	3.2	5.0	36
4.2	1.2	0.4	3.2	10.0	68

Table 24. Analyses of Reddish Chestnut. (26)

Sample No.	Horizon	Depth	pH	Organic ~~Matter~~ Carbon	Size Class and Diameter of Particles (*in mm.*)							Other Classes (*in mm.*)		
					Very course sand 2–1	Coarse sand, 1–0.5	Medium sand, 0.5–0.25	Fine sand, 0.25–0.1	Very fine sand, 0.1–0.05	Silt, 0.05–0.002	Clay, <0.002	0.02–0.002	<0.005	>2
		Inches		*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
48752	A_1	0–10	5.9	1.4	0.1	5.0	11.6	30.2	13.0	14.2	25.9	5.6	28.4	0
753	A_3	10–16	6.6	0.6	0.4	7.1	11.8	23.0	9.4	14.6	33.7	9.9	37.1	0
754	B_2	16–32	6.9	0.3	0.5	5.7	11.2	23.3	10.4	14.7	34.2	8.6	36.9	<0.5
755	C_c	32–43	7.4	0.1	0.2	6.6	13.4	26.7	10.1	14.9	28.1	9.5	31.5	0
756	C	43–48	7.6	0.1	0.3	5.6	14.5	33.0	12.6	14.8	19.2	9.6	22.6	1

Sample No.	Horizon	Depth	Exchangeable Cations me/100 g					Sum of Cations me/100 g	% Base Saturation
			Ca	Mg	Mn	K	H		
48752	A_1	0–10	10.5	6.3	0.09	0.3	6.5	23.7	73
753	A_3	10–16	10.5	8.1	0.02	0.4	3.4	22.4	85
754	B_2	16–32	11.1	8.6	<0.01	0.4	1.9	22.0	91
755	C_c	32–43	12.2	8.7	<0.01	0.7	0.8	22.4	96
756	C	43–48	14.7	8.0	<0.01	0.9	0.3	23.9	99

Congo Soil Profile No. 26

U. S. GOVERNMENT PRINTING OFFICE 16—46512-2

Congo Soil Profile No. 39

U. S. DEPARTMENT OF AGRICULTURE

Sample No.	Horizon	Depth	pH	Organic matter	Very coarse sand 2–1	Coarse sand 1–0.5	Medium sand 0.5–0.25	Fine sand 0.25–0.1	Very fine sand 0.1–0.05	Silt 0.05–0.002	Clay <0.002	Other Classes (in mm.) 0.05–0.002	<0.002	>2
		Inches		Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
39	A	0–10	6.2	1.40	0.0	1.4	11.6	30.4	10.4	14.1	32.1			0
	B	10–18	6.2	0.61	0.0	1.3	8.4	28.2	10.1	14.8	37.2			0
	C	18–33	6.2	0.34	0.0	1.3	7.8	28.3	10.4	14.8	37.4			0
	B	33–48	6.2	0.23	0.0	1.3	7.4	28.3	10.4	14.8	37.8			0
	C	48+	6.2	0.22	0.0	1.3	6.4	28.4	10.4	14.8	38.4			0

Mechanical analysis of fine earth (less than 2 mm.)

Fine Clays and Dispersion of Particles (in mm.)

Sum of centrifuge bases as % of H₂O equivalent

As we go east of the park headquarters, I look at a fairly good profile of Reddish-Chestnut soil (southern Chernozem). This is about 15 kilometers east of sample No. 25. The slope is only about 1 percent on a gently undulating plain. The vegetation is mainly grass, but there are shrubs, low trees, and Euphorbias.

Soil Profile Sample No. 26

A_1	0 - 10"	Very dark brown to black heavy loam or clay loam with mellow crumb structure. Very dark gray when dry.
A_3	10 - 16"	Dark brown, streaked with black, mellow clay loam. Dark brown when dry.
B_2	16 - 32"	Dark brown clay loam; broadly prismatic with ill-defined nut; easily friable. Brown when dry.
C_C	32 - 43"	Yellowish-brown clay loam mottled with white and dark brown. Light yellowish-brown when dry.
C	43 - 48" plus	Soft yellowish-loam with eyes of calcium carbonate. The material is Pleistocene lake sediments. Pale brown when dry.

The plant roots go down to the C_C horizon. I regard this as a good example of the main soil here. In the depressed areas, I see more chernozemic Wiesenboden with more trees. This pattern of Reddish-Chestnut soil like Nos. 25 and 26, and with the chernozemic Wiesenboden, continues for a long ways southeast, even far beyond the National Park.

At 48 kilometers, I see a little coffee plantation. But generally there is very little farming yet even though we are

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K-1408 June 14, 1947
Belgian Congo. In Albert National Park, a few kilometers east of headquarters. Landscape of Reddish-Chestnut soil.

K-1409 June 14, 1947
Belgian Congo. In Albert National Park, a few kilometers east of headquarters. Landscape of Reddish-Chestnut soil. (In foreground grass tramped out by animals going to water.)

K-1408 June 14, 1947
Belgian Congo. In Albert National Park, a few kilometers east of headquarters.
Landscape of Reddish-Chestnut soil.

K-1409 June 14, 1947
Belgian Congo. In Albert National Park, a few kilometers east of headquarters. Landscape of Reddish-Chestnut soil. (In foreground grass trampled out by animals going to water.)

getting into a more moist climate. I can just see the volcanoes ahead and as I do it begins to rain.

Just above the lake plain on the border terraces and slopes, Director Jurion says there were many coffee plantations started a few years ago, but several have failed from poor yields. We are out of the lake plain at about 55 kilometers and I look at the soil a little ways north of Rutshuru. There is a black A_1 6 to 10 inches deep over dark reddish-brown soil with reddish gravels at various depths. Now there is a great deal of farming -- bananas, maize, taro, beans, cassava, papaya, squash, some coffee, and a very little oil palm. At 7 kilometers north of Rutshuru, we leave this terrace and pass over shallow soil from volcanic lava. Where the soil is deep, it has the same crops as just listed. I pass a fairly good-sized arabica coffee plantation. The very surface of the soil is black. Underneath is a dark brown horizon resting over a yellowish-brown one. The open land and fallows have mostly tall savanna. We pass some more large plantings of coffee, partly open and partly under thin shade. Most of the coffee looks good although a few plants show some chlorosis.

I stop 18 kilometers beyond Rutshuru at the Katale plantation to look at a soil from volcanic rocks now used for coffee and food crops. The land is undulating to strongly

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Just above the lake plain on the border terraces
canoes ahead and as I do it begins to rain.
getting into a more moist climate. I can just see the vol-

rolling and there is great variation in the depth and color of the rocks.

A_1	0 - 12"	Very dark brown to black granular clay loam.
A_{30}	12 - 22"	Dark brown clay with weak nut structure; easily friable to crumb.
A_{31}	22 - 36"	Dark yellowish-brown stony clay mottled with dark brown.
A_{32}	36 - 50"(36-72")	Yellowish-brown stony clay.
C	Below 36 - 72"	Gray stony rubble.

This is a very fertile soil. Food crops are excellent even without fallow.

At 22 kilometers we start up a steep slope. There are very good food crops on slopes up to 50 percent. We pass through a large area of this soil, strongly rolling to hilly. There are more trees now in the fallows and rather heavy forest on the lower slopes to the west. We pass a very large mission in this thickly populated area. Of course, both Catholic and Protestant missions are scattered all over the Congo. The soils along here are developed from lava, volcanic ash, cinders, and all sorts of mixtures of the three. Most of the soils in the plains are too rocky for use; many of these plains are simply lava beds.

At 37 kilometers from Rutshuru, we enter another park. There is heavy forest. The soils are generally thin and stony, but quite fertile. After the park, we pass another pyrethrum

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plantation. We then come into an area where food crops are produced in raised beds up and down the slopes. There is some erosion, but not very much, since the water flows over the rocky substratum. This reminds me of a similar practice used in growing tobacco on some of the thin steeply sloping soils of Puerto Rico. Here again is more pyrethrum; some of it is on very steep slopes. At 47 kilometers we are back in an area of thin forest on thin soil.

The natives here look healthier than most I have seen, especially the women. Most of them wear only simple skirts of goat skin. These are Bahavu (?) people. Unfortunately, the tops of the volcanoes are in the clouds.

At 50 kilometers the road is on an undulating rocky plain with grasses and shrubs. There is forest on the slope to the west and food crops on those far to the east. Along here at 52 kilometers, we pass a cemetery where Belgians were buried who were killed in the first World War with the Germans.

As we start down the slope toward Lake Kivu, we see mostly food crops -- bananas, beans, maize, grain sorghums, cassava, and sweet potatoes -- a little tobacco, and a few castor beans. Here the soil is worked deeply in raised beds. They follow clean cultivation mostly, with some mixing of the crops, especially bananas and beans. They have some terraces on the strong slopes over 12 percent. Unfortunately,

terraces on the strong slopes over 12 percent. Unfortunately, the crops, especially bananas and beans. They have some plantation. We then come into an area where food crops are produced in raised beds up and down the slopes. There is some erosion, but not very much, since the water flows over the rocky substratum. This reminds me of a similar practice used in growing tobacco on some of the thin steeply sloping soils of Puerto Rico. Here again is more pyrethrum; some of it is on very steep slopes. At 47 kilometers we are back in an area of thin forest on thin soil.

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there is no water here and the natives carry it on their heads from Lake Kivu. The land gets much drier as we go down the slope toward Goma. There is an increasing amount of grain sorghums among the food crops and of Euphorbia in the wild places on the thin rocky soil.

We arrive at Goma at 1:30 p.m. and have lunch at the Hotel des Volcans. We drive out west from Goma a little way north of Lake Kivu. The land is undulating to strongly rolling with thin stony dark brown soil over lava. The cover is mostly thin forest with some dense second growth and some mixtures of forest and savanna. In places there are thick beds of black fine cinders. About 20 kilometers west of Goma, we come to the great lava flow of 1912. There are very thin stands of low trees and shrubs. The lava is nearly black, hard, porous, brittle, and cindery. The surface is exceedingly uneven. Beyond this is the great 1938 lava flow. The rock is dark brown to black and ropey. Only a few small ferns grow on it.

Along this road I see many natives migrating from the overpopulated lands to the east to the nearly empty lands to the west. West of Sake are beautiful mountains with thin forest and many small cultivated fields.

We return to the hotel and I have splendid quarters in a detached apartment.

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June 15: Goma to Astrida (Ruanda)

We leave Goma at 7:30 a.m. and go along the north shore of Lake Kivu toward the east. There are many beautiful homes and gardens along the road. Director Jurion says this might be called the "Miami of the Congo".

Shortly after leaving Boma, we pass from the Belgian Congo proper to the mandated territory of Ruanda Urundi. The Germans were driven out of this area by the Belgians during World War I and later Belgium received it as a mandate. The population here is much more dense than in most of the Congo. In this little mandated region, there are somewhat over 3,000,000 people, whereas the Congo has only a little over 10,000,000.

We go almost at once into hilly land, a large part of which is cultivated even on very steep slopes. Most of the land has crude native style terraces, although there are many fields terraced according to the suggestions of the agricultural advisors. Soil erosion is significant on some fields of over 50 percent slope. In fact, there are some places that have obviously been abandoned because of the steepness of the slope and the hazard of erosion. Northeast of Goma, we see mostly food crops along with some plantings of coffee. Right here there are not so many animals, but in the mandate as a whole, there are excessive numbers, especially of cattle. It is estimated that there may be about a million cattle in addition to

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many goats and sheep.

Near Nyondo and beyond, I get some pictures of native agriculture, including bananas, sweet potatoes, beans, maize, and cassava. Like north of Goma, many of the soils in the valley are thin and rocky. Here they are about one-half non-arable. Also, many of the food crops like sweet potatoes and beans are grown in raised beds.

This is a beautiful country. Nearly every foot of these fertile soils is used for food crops. Many slopes are cultivated up to 70 percent and some above that. On the whole, the soils are so productive that frequent fallowing is unnecessary.

There are great variations in the color and thickness of the lava and cinders. The substrata vary in color from yellowish-brown to black.

I see a few strawberries along here that are growing perched on little flat-top hills. Each of these is about 5 inches high and 18 inches across and they are spaced in the planting about 1 meter by 1 meter.

As we get up in the mountains about 2,000 meters, I begin to see lots of peas and the bananas nearly drop out. There is a little pyrethrum. Trees have been planted generally along the road and on many of the slopes. Most of this tree planting is relatively new since Director Jurion tells me that

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when the area was taken from the Germans there were practically no roads or trees at all in the mandate.

About 30 kilometers from Goma, we are in very cool high mountains with only a small percentage of arable land. The cover is heavy shrub with scattered trees. Some cattle are grazing in these highlands.

At about 40 kilometers, there are again crops on the slopes with cattle grazing on the thin soils and on the wet soils in the valley.

There are a great many people along the road. It seems to me that it must be very cold in the morning for the naked children. Both boys and girls up to about 10 years of age are generally naked. It is interesting that the natives in the warm parts wear more clothes than the natives in the cold parts.

Considering the deep cultivation without fallow on the steep slopes, one marvels that there has not been more erosion. But in the very steep places there have been some important slides or slips. Erosion sometimes begins after the slip. Certainly these places should be immediately planted to trees. Where this has been done, the soil is well stabilized.

As we drive on we see more and more cattle, here largely confined to the smooth rocky valley lands since the hills are nearly all in food crops.

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about 10 percent of the population. Work is socially unacceptable to these people. Most of them are very tall and have long slender heads. They do not look so strong and healthy as the ordinary natives.

At about 55 kilometers from Goma there is a native market, and for a considerable distance each side of it the road is simply swarming with people. On the slopes the principal crops are beans and sweet potatoes. Peas are grown but there are no bananas. This continues for some distance. Perhaps 10 kilometers farther on, we come to an enormous valley where one can see for miles over strongly rolling land with crops only in small patches, and these include bananas.

Near Ruhengeri we come to a good area of valley land with coffee, bananas, beans, a little tobacco, some peas, some castor beans, maize, and cassava. There are beautiful Eucalyptus trees along the road. There is a large market here at Ruhengeri.

As we continue southeast, other igneous rocks besides the volcanics appear. The soils have a dark brown A_1 with red or reddish-brown B's. The land is very hilly and cropped less intensively, with more fallow, than on the deep soils from the volcanic rocks. But it is a gorgeously beautiful country.

I take a picture at 13 kilometers where bananas, beans, sweet potatoes, and maize are growing. The soil is rather heavy. It has a dark brown surface with a reddish-brown to red B.

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The soil is developed mainly from diorite with possibly some influence of volcanic cinders and ash. There are very old terraces on these fields which have been cultivated for a very long time. In the more recent field layouts, planned with the help of the agricultural advisors, the terraces are longer and more regular than in the old native fields.

We go for a long way through this gorgeous mountain country almost too beautiful to believe. On the whole, the land is farmed well. The Advisory Service has helped to improve the terraces and to establish trees along the roads and in the critical places on the hills. The soil is deep, pervious, and fertile. There are many little plantings of coffee grown by the natives. The agricultural advisors have wisely pushed this enterprise because it is something that can be done on a small scale and the product gives the natives a little money and somewhat more freedom of action. There are a few cattle in this region, but not many. Interestingly, there are almost no bottom soils. The hills come down to sharp V-shaped valleys. The rocks include igneous and metamorphic kinds, high in basic minerals, along with some volcanics.

In the high areas some wheat is grown, protected by terraces and grass strips. I take a picture of one of these fields where the soil is a deep fine sandy clay loam over schist, roughly as follows:

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A_1	6 - 8"	Very dark brown fine sandy clay loam; mellow and friable.
A_3	8 - 20"	Reddish-brown, slightly compact but friable, fine sandy clay loam.
B_2	20 - 72"	Like the above, but somewhat more reddish.
B_3	72 - 96"	Reddish gravelly, cobbly concretionary laterite; although pervious, it digs out with some difficulty.
C	96" plus	Yellowish-brown, mottled with ocher and gray, highly weathered fine-grained micaceous schist.

All the soils here are developed from more or less colluvial wash and accumulations on the slopes.

As we drive on, pastures predominate on slopes above about 50 percent. In the cropped areas, I see quite a few small eroded spots not yet planted to trees. These originated from slides followed by wash. The wonder is that there aren't more of them. The agriculture people know what to do and have already made excellent demonstrations. They are under great handicaps in this region because of the overpopulation and because of the entrenched tradition of social prestige depending upon the number of cattle that a person has.

We begin to see some narrow first bottoms that are wet and swampy during the rainy season. Now, at the beginning of the dry season, they are beginning to work them over deeply with heavy broad hoes. The land is worked up into small raised beds for maize and beans.

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K-1410 June 15, 1947
Ruanda. Just beyond Nyondo, east of Goma. Characteristic view of small native plots of bananas, sweetpotatoes, beans, maize, cassava, etc., on strongly sloping dark-brown lateritic soil from basaltic lava.

K-1411 June 15, 1947
Ruanda. 18 kilometers east of Goma. Intensive cultivation to bananas, sweetpotatoes, beans, maize, cassava, etc., of dark-brown lateritic soil from basaltic lava (right) and valley land (left). Small native village in left center.

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K-1412 June 15, 1947
Ruanda. About 29 kilometers southeast of Ruhengeri. Wheat on reddish-brown lateritic soil from schist with terraces as recommended by agricultural advisory service. New forest planting (1940-41 probably) on critical spot in background.

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Ruanda. 60 kilometers east of Goma. Dark brown soil from volcanic rocks, a little too high for bananas. Crops are mainly beans and sweet potatoes. Shows native strip cropping.

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Ruanda. 13 kilometers southeast of Ruhengeri.
Dark brown heavy soil with red B from volcanic cinders and ash. Long established native terraces. Crops are mainly bananas, beans, and sweet potatoes.

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At 55 kilometers beyond Ruhengeri we leave the main road and take the one by the Rulindo Mission. Here there are slopes cultivated with terraces up to 100 percent. These seem to work all right in the V-shaped valleys, but not on the "noses" between the drainageways. These noses are mostly in pasture and new forest plantings,yet there is serious erosion in some places that are critically in need of reforestation.

At Rulindo we enter a rather broad valley that is partly swampy. The hills on the side are still steep but more rounded and not quite so rugged. After a few kilometers, we leave this valley and cross over to the one leading to the southeast. Here again the relief is very bold. The soil is partly cultivated, but there is a larger proportion of pasture than formerly, some of which is overgrazed and eroded. The soil is from metamorphic rocks, rather heavy but pervious.

A_1	0 - 12"	Dark reddish-brown fine sandy clay.
B	12 - 30"	Reddish-brown fine sandy clay.
C_C	30 - 60"	Concretionary gravels.
C_1	60 - 90"	Mottled clay with some pieces of lateritic hardpan.
D	90 - 100" plus	Gray weathering schist.

A little farther on, I look at the soil again. This is probably a "Red Loam" from schist. The slope is about 60 percent. Probably this area was forested once, but it has been in grass for a very long time. Perhaps the soil has been partly truncated long ago.

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(4) Medical technician, 4 years plus 2 years of practical training
(5) Chief's candidate, 3 years plus 1 year of practical training

The students must not be married until they have completely finished the work for their diploma. The students I see about the school are 14 to 21 years of age for the most part.

In the advanced courses, the French language is used entirely, whereas they use the native language in the primary schools. All of the students must learn typing.

Scholarship standards are rigidly enforced. About one-third of a class is eliminated during the first year and a half. Then about one-third is eliminated in the last year of the Ecole moyenne. Only about one-third graduate from the professional sections.

I look over the books of a third-year agricultural student. These contain quite serious discussions of physics, chemistry, etc. in simple form. Then he has rather simple, but serious, books in the several branches of technical agriculture. In engineering they discuss terrace construction, but the students are given nothing about gas engines or tractors. I am told that another school is being opened that will offer engineering for the natives.

All students sleep in dormitories on iron cots. The first-year students must sleep on the native mats since the

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chances are that they may not continue and shall need to go back to their villages. Those who complete the first year successfully have mattresses. The boys are dressed alike in khaki shirts and shorts. All students have their share of work to do in the fields and gardens of the school and in keeping the place clean and in good order. Sons of chiefs are treated exactly like others.

Director Frére Secundien shows us about. He gives me the impression of being a sincere and competent man who likes the boys, but who is a strict disciplinarian. On the whole, I have a very good impression of this school.

We leave Astrida to visit the experiment station at Rubona. This is a little way north of Astrida. I notice from the road that many of the peasants have beehives hanging in trees. At first glance these suggest big bundles of sticks. Generally, the soil in this area is overcultivated. There is too little fallow. Since the cattle are allowed to graze the fallow the bad grasses come in on account of a lack of shade. Then the soil is worked very deeply in order to remove the grass roots.

There is some erosion already and I have no doubt it is increasing. Somehow the cattle numbers must be reduced. It is obvious that the farm people, and more especially the women, work very hard in this area.

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There are quite a few patches of coffee, most of which is mulched with grass cuttings. The available manure is used mainly on bananas and coffee.

This experiment station at Rubona is not administratively under the INÉAC. So in respect to their management, M. Jurion is an advisor. The house and grounds of the station are very nice indeed. Director Lejeune and his wife have a gorgeous home and garden in excellent taste. There are over a hundred kinds of roses and a great many other flowering plants, herbs, and ornamental trees. They also have rock gardens in sun and rock gardens in shade. I have never seen a nicer garden.

They have introduced some cork oak at the station which seems to be doing well and may turn out to be a practical crop here, especially when combined with forest plantings for erosion control.

The Fordii tung growing here does poorly, but Montana tung does well.

The chief interest here at the station is in horticultural crops although they do have some work with food crops and crops for animal feed.

I look at the soil in a deep fresh pit on the margin of a coffee planting. There is considerable variability in the individual soil horizons. The slope is about 5 percent.

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Soil Profile Sample No. 27

A_1	0 - 10"	Very dark reddish-brown to nearly black fluffy heavy granular fine sandy loam; many grass roots. Dark reddish-brown when dry.
A_{30}	10 - 16"	Dark reddish-brown heavy fine sandy loam. Reddish-brown when dry.
A_{31}	16 - 23"	Reddish-brown gravelly heavy fine sandy loam. Red when dry.
B_1	23 - 40" (irregular)	Dark brown to dark reddish-brown gravelly heavy fine sandy loam. Reddish-brown when dry.
B_2	40 - 65" (very irregular)	Red gravelly and cobbly (concretionary) fine sandy clay; now moist. Reddish-yellow when dry.
B_3	65 - 75" (irregular)	Mottled stony lateritic clay. Reddish-yellow when dry.
C	75" plus	Partially weathered schist.

I also take a sample of the pasture grass.

The soils in this area have a great variety of profiles, as might be expected. This one is very common. In some, there is less gravel, especially on the lower slopes that have received covering material from above.

In this region most of the women wear very plain clothes--either black or brown simple skirts from cloth or goat skin. About one-half of them wear an upper garment. A few of the very tall girls belonging to the nobility class wear long

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white dresses and the men of this class are also dressed in black and white.

Where sample No. 27 was taken, and beyond, there is a high proportion of pasture, but also a significant amount of food crops, including the grain sorghums.

We pass a large tin mine at 26 kilometers just before joining the main road. Along here one sees quite a bit of erosion from the overgrazing of steep land. Obviously the cattle numbers are far too high for the resources.

Going on south toward Kigali after joining the main road, one sees only a small proportion of food crops, but rather more overgrazed hills. A papyrus swamp borders the Akanyaru River a large part of the way. Near Kigali the percentage of food crops increases again. These include grain sorghums, maize, bananas, and cassava.

Here we see some more of the "gentry" fully clothed in flowing cotton garments. Most of these are black and white, but some wear colored cotton sheets or loose-fitting garments. These people are tall, slender, and rather degenerate in appearance as compared to the other natives.

As we go south, we are getting into warmer drier country. The bushes and grass are intensely grazed. Euphorbias and other dry land plants appear. There is only a very small percentage of food crops in the hills. There are altogether too many cattle -- these native cattle of Ruanda with

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the long horns.

The hills become softer and lower. The rock is mostly a highly micaceous schist.

Near the tops of the ridges much of the soil has a dark gray surface, somewhat gravelly, extending down 1 to 3 feet. It is very hard beneath when dry. Underneath this surface is a mottled heavy gravelly clay, almost like rock when dry. It is mottled and streaked with brown over dark gray and reddish-brown. There is an increasing number of relatively large fragments of mica with depth, down to the weathered gneiss. On the lower slopes the soil is redder. /a

The land is strongly rolling to hilly with a few rock outcrops. There is a small but significant percentage of food crops. There are altogether too many cattle, herded by naked boys. We pass a large mission just below the main crossroads and here more food crops are grown. For some distance south the land is rolling to strongly rolling. There is a fair percentage of food crops, a large part of which is grain sorghum.

At irregular intervals along here, I see some nice looking houses. These are rest camps for the European administrative people to use while they are traveling in "the bush".

There is not much erosion in this strongly and gently rolling area despite the large numbers of cattle, but here and

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/a Added later: This dark clay soil of the ridge tops is also seen as the principal soil at the cattle breeding station of ~~Nyahaga~~ Nyamihaga.

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\a Added later: This dark clay soil of the ridge tops is also seen as the principal soil at the cattle breeding station of Nyabogo-Nyamirago.

there I see some serious spots. Of course, the dry season is only beginning. Therefore, pastures will likely look quite bad in two months and one might get an impression of more erosion then than now. In a few spots I see soils that look like Rendzinas, but the material underneath is a mixture of quartz and weathered feldspar.

Along here the people wear more clothes. We meet a native on a bicycle. He is some kind of little chief and has a servant running behind him to carry his pipe. And it is not a very big pipe.

About four o'clock we pass Nya'nza. This is a nice looking little place where the King holds his court and where the Governor has his headquarters. Director Jurion makes arrangements for us to have an audience tomorrow. The soils in this region on the whole are less red and less productive than those farther north. We stop briefly at the experiment station and go on to Astrida. The amount of food crops increases. The population is very dense here. We see some accelerated erosion, especially where the crop rows and the ditches run directly up and down the slope.

We reach Astrida just before dark. I am very tired. The distance has not been so great, but the road today was extremely winding and took us over great changes in elevation.

I am continually impressed by the great scholarship

I am continually impressed by the great scholarship
and courtesy of the Abyssinians. Ras Hailu is a
splendid host. He has a very fine house and a
beautiful garden. He has also a very fine car.
We left Addis Ababa at 8:30 this morning and
started on the road to Debra Markos. The road
is very good and we made excellent time. We
passed through a very beautiful country. The
hills are covered with trees and the valleys
are green with crops. We saw many herds of
cattle and sheep. We also saw many camels.
The camels are used for carrying salt from the
salt mines to the markets. We passed through
several villages. The houses are round and
have thatched roofs. We saw many people
working in the fields. They were using
primitive wooden ploughs. We saw many
women carrying water jars on their heads.
We arrived at Debra Markos at 1:30 this
afternoon. Debra Markos is a small town
situated on a hill. It has a population of
about 5,000. We were met by the Governor
and his staff. We were taken to the Governor's
house where we had lunch. After lunch we
were shown to our rooms. We have a very
nice house with a garden. We have also a
very fine view of the surrounding country.
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and understanding of Director Jurion, my traveling companion. In fact, he has everything: scholarship, poise, firmness, kindness, social vision, and a thoroughly practical point of view.

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June 16: Astrida, Rubona/a and Nya'nza

I am up early to visit a school for native young men in Astrida. The school is maintained by the Government and is run by the Frére de la Charitie. The boys are selected from the various mission schools by examination. Those with wealthy parents pay the school fees, but poor boys attend the school at Government expense. There are more, however, from the families of the black gentry than from those of the peasant class. There are special classes for the candidates for chief. A chief can send all his sons to the school, but he needs to pay the cost. Before coming to this professional school, it is necessary for candidates to have completed successfully six years of primary school.

First they get four years in the "Ecole moyenne". This includes a general course with language, humanities, algebra, a little geometry, some natural science, and a little French literature. This is probably somewhere near our Junior High School.

After that there are five courses available:

(1) Secretarial work, 1 year
(2) Agriculture, 3 years plus 1 year of practical training
(3) Veterinary technician, 3 years plus 1 year of practical training

---

/a The elevation is about 5200 feet and the rainfall about 40 to 50 inches.

Pages 161, 162 & 163 misplaced after 154

June 16: Astrida, Rubona[a] and Mya'nza

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[a] The elevation is about 5200 feet and the rainfall about 40 to 50 inches.

The A horizon has likely been thickened here a little by erosion deposition from above many years ago. The black B_2 is curious.

Soil Profile Sample No. 28

A_P	0 - 12"(8-20")	Medium to dark brown rather loose granular sandy clay loam. To purplish-gray when dry.
A_{11}	12 - 22"(15-25")	Like the above but somewhat firmer.
B_1	22 - 40"(36-48")	Medium to dark, slightly reddish, brown sandy clay loam; somewhat firm, but easily friable to crumb; poorly developed nut structure when removed. There is some slight mottling with dark brown. Reddish-brown when dry.
B_2	40 - 62"(55-70")	Very dark brown to black sandy clay loam with some streaks and spots of brown. This horizon varies greatly in thickness and mottling. In places it is only 5 inches thick and in other places 30 inches. Tongues penetrate into the B_3. The material is firm, but easily friable.
B_3	62 - 75"(70-80")	Mottled firm clay; massive in place but digs out in irregular nut that is friable with considerable pressure. The colors are dark brown, brown, and orange-red. Yellowish-red and reddish-brown when dry.
C	75 - 80" plus	Orange-red clay mottled with brown and yellow; heavy and firm. The soil digs out with a pick with some difficulty but the pieces are quite easily friable. Reddish-yellow when dry.

Roots penetrate the whole solum into the upper B_3.

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Roots penetrate the whole solum into the upper B_3.

Table 18. Analyses of Reddish-Brown Latosol (with buried soil). (28)

Sample No.	Horizon	Depth	pH	Organic Matter Carbon	Size Class and Diameter of Particles (*in mm.*)							Other Classes (*in mm.*)		
					Very course sand 2–1	Coarse sand, 1–0.5	Medium sand, 0.5–0.25	Fine sand, 0.25–0.1	Very fine sand, 0.1–0.05	Silt, 0.05–0.002	Clay, <0.002	0.02–0.002	<0.005	>2
		Inches		*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
48766	A_p	0–12	5.5	1.6	8.4	17.9	10.9	18.6	6.2	7.6	30.4	4.0	31.6	0
767	A_{11}	12–22	6.7	1.3	9.1	13.8	9.7	19.0	7.3	8.4	32.7	4.6	34.0	<0.5
768	B_1	22–40	5.0	0.7	9.5	12.9	8.7	17.4	6.7	8.0	36.8	3.9	37.7	1
769	B_2	40–62	4.7	1.8	7.0	11.6	7.3	13.6	5.7	6.1	48.7	3.2	49.6	<0.5
770	B_3	62–75	4.4	0.6	7.4	7.9	5.6	12.1	5.6	6.1	55.3	3.2	56.2	1
771	C	75–80	4.4	0.3	9.0	7.4	4.5	9.4	4.4	4.3	61.0	3.4	61.5	1

			Exchangeable Cations me/100 g					Sum of Cations me/100 g	% Base Saturation
			Ca	Mg	Mn	K	H		
48766	A_p	0–12	3.0	1.1	0.09	0.7	9.1	14.0	35
767	A_{11}	12–22	1.8	0.6	0.06	1.8	8.9	13.2	32
768	B_1	22–40	1.0	0.4	0.05	0.9	8.8	11.2	21
769	B_2	40–62	2.3	0.1	<0.01	0.2	24.5	27.1	10
770	B_3	62–75	2.4	0.1	0.01	0.1	11.3	13.9	19
771	C	75–80	1.4	0.1	<0.01	0.1	7.7	9.3	17

Congo Soil Profile No. 28

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Congo Soil Profile No. 38

Size Class and Diameter of Particles (in mm.)

Sample No.	Horizon	Depth	pH	Organic Matter	Very coarse sand 2-1	Coarse sand 1-0.5	Medium sand 0.5-0.25	Fine sand 0.25-0.1	Very fine sand 0.1-0.05	Silt 0.05-0.002	Clay <0.002	0.02-0.002	>0.005	<2
					Exchangeable Cations m.e./100 g.									
			Ca	Mg	K	Na								
4878	A	0-12	5.2	1.6	0.3	0.1	4.8	17.8	8.3	7.6	50.4	4.0	21.8	0
789	A1	12-30	5.7	0.3	0.1	0.1	1.4	3.8	2.7	1.8	83.1	4.6	5.2	0
790	B1	30-52	4.4	0.8	0.1	0.1	3.0	7.4	5.2	4.2	75.8	3.3	12.6	0
791	B2	52-75	4.4	0.3	0.1	0.1	3.0	7.4	5.2	4.2	75.8	3.3	12.6	0
4879	C	75-90	4.4	0.3	0.1	0.1	3.0	7.4	5.2	4.2	75.8	3.3	12.6	0
792	A	0-12	5.2	1.3	0.4	0.2	4.8	17.8	8.3	7.6	50.4	4.0	21.8	0
793	A1	12-30	5.7	0.3	0.1	0.1	1.4	3.8	2.7	1.8	83.1	4.6	5.2	0
794	B1	30-52	4.4	0.8	0.1	0.1	3.0	7.4	5.2	4.2	75.8	3.3	12.6	0
795	B2	52-75	4.4	0.3	0.1	0.1	3.0	7.4	5.2	4.2	75.8	3.3	12.6	0
4880	C	75-90	4.4	0.3	0.1	0.1	3.0	7.4	5.2	4.2	75.8	3.3	12.6	0

Sum of Cations Base Saturation

U. S. GOVERNMENT PRINTING OFFICE 16—40215-3

This soil is said to be good for tree crops, but not for annual crops. They are trying regeneration with forest fallow. Acacia and cypress trees are the best fallow and grass is the poorest.

I see a planting of pineapples suffering very badly from chlorosis. I believe this could be cured with ferrous sulphate as a dust or spray. Plantings of avocados and citrus look well.

I look at another profile on a slope of about 7 percent. I suspect there may have been some removal by erosion at some time in the past.

A_P	0 - 12"	Dark gray somewhat gravelly clay. Medium cloudy and friable with difficulty when dry. Somewhat more compact in the lower part.
B_{10}	12 - 20"	Dark brown gravelly sandy clay; irregular blocky structure; very hard when dry and plastic when wet; friable with difficulty.
B_{11}	20 - 27"	Transitional.
B_2	27 - 48"(45-50")	Sandy clay, faintly mottled very dark brown and black; massive but digs out in irregular blocks; friable with difficulty; hard when dry.
B_3(or C?)	48-52" plus	Orange-red coarse sandy clay; massive; hard when dry; grades into weathered granite.

Roots penetrate to about the middle of the B_2 horizon.

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Roots penetrate to about the middle of the B_2 horizon.

I look at another profile lower on the same slope that appears to me to have been possibly truncated at one time and then later had a redeposition of material from above. This profile and the previous one are both in grass fallow now. Here is also a black B horizon.

A_p	0 - 17"	Dark brown heavy sandy loam or sandy clay loam; easily friable to soft crumb when moist and hard when dry.
B_1	17 - 32" (30-40")	Like the above but darker and with spots and streaks of very dark brown.
B_2	32 - 45" (44 - 50")	Black gravelly clay. The gravel pieces are partly quartz and partly concretions. When broken, these are red, white, orange-red, and brown. The soil is massive and hard when dry.
B_3 (or C)	45" plus	Orange-red coarse sandy and gravelly clay from granite. Massive. The soil is hard to dig out but friable when removed. This is like B_3 in the previous profile. (Roots go to the B_2 and a few enter it.)

I look at another soil some distance away in a slight saddle of a long slope of about 3 to 4 percent. Unfortunately, the main excavation has been made in an old roadway. There is coffee under the partial shade of low legume trees on one side and cinchona on the other. The surface soil is examined in the cinchona planting.

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A_p	0 - 15"	Dark, faintly reddish, brown sandy clay loam. When moist, the soil has a soft crumb structure. When dry and packed, it is very hard.
B_1	15 - 40"	Reddish-brown sandy clay with soft mellow crumb. Very hard when dry and packed. Slightly darker in the upper part. There are a few small soft concretions.
B_2	40 - 62" plus	Reddish-brown sandy clay mottled with very dark reddish-brown to black. Firm but easily friable when removed. Sticky when moist.

It is too bad this profile is a little shallow. The soil was just getting a little more compact when the excavation stopped. In the lower part there are many incipient soft dark concretions.

I see a fourth profile nearby. At 6 feet the black mottling of the B_2 fades out into more nearly uniform reddish-brown.

These soils are on a long slope and are developed from colluvial material that may have somewhat more basic minerals in it than commonly found in weathered granite. There has been no recent erosion or deposition. The hard rocks are very deep.

On the station I see some good maize that I estimate to yield 40 to 50 bushels per acre. There are a large number of trial plots of all food crops and fruits likely to be adapted to the region. The station distributes cassava cuttings and other seeds and cuttings to help the natives get improved yields. The station has a very large collection of grain sorghum varieties, including over 40 native ones. I see some cannas used as

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K-1524 June 16, 1947
Ruanda. Rubona. Coffee Arabica under partial shade of Leucaena-glauca -- a woody legume. Coffee plant 6 feet high.

K-1524

K-1524 June 16, 1947

Rwanda. Rubona. Coffee Arabica under partial
shade of Leucaena glauca -- a woody legume.
Coffee plant 6 feet high.

forage. Under good conditions, they may get 40 tons of tubers and 100 tons of leaves per hectare. Cattle eat both and the roots can serve as human food.

I see some nice arabica coffee under the partial shade of Leucaena glauca, a woody legume. The coffee is kept well mulched.

I stop and look at the home of one of the skilled native helpers who is a graduate of the agricultural school I visited this morning. He has a wife and three children. The house is made of brick and has a metal roof. There is a small living room, two bedrooms, and a bathroom on one side of a small court, with a kitchen, storage room, and toilet room on the other side.

We have a most excellent lunch with the Director and his wife.

After lunch we go to visit the cattle breeding station of Nyahaga. This station is also not directly under INEAC. First we see the sacred cows of Ruanda. Over a very long time, these have been selected for long horns. Of course, they are very poor cattle as cattle. Each animal has its own boy. In ceremonies, the ancestry of each one is mentioned. I get a good picture of one having a horn spread of 247 centimeters. I am told that 12 of these are now being sent to the United States -- 6 for the circus, 3 for the Bronx Zoo, and 3 for President Truman. I am also told that they are to go by plane, but this I find hard to believe.

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We go to look at the cattle selected by the station. Many of these have long horns. Although not too good, there is some improvement over the native stock seen along the highway. This station is supposed to work with native breeders and have cattle that belong to the native owners. I see some cattle without horns, but I am told that many of these are not so good in other ways. Their colors include white, roan, black, and brown. The small hornless type would seem to me probably the best. I am not very well impressed with this work; but perhaps I don't understand it well enough. The cattle are not sufficiently segregated. There seems to be a good deal of uncontrolled breeding and a general lack of accurate records.

I am amused to watch the natives threshing oats. It rained last night and the oats are obviously too damp for threshing, but they are threshing anyway. Some 20 to 30 natives sit in a big circle within a stone barn and flail the oats with sticks, along with a kind of mumbojumbo singing. Then they shake the straw and beat it some more. Then the straw is shaken and carried out by small boys. The grain is swept up from the floor with brushes made from bushes and straw. Then it is carried out in large wooden trays and winnowed by women. Finally, the oats are left on huge shallow trays to dry and the last bits of straw picked out by hand. The oats are not very bright. It is said that they are yielding about 1½ tons per hectare.

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The soil here is strongly rolling and has a dark grayish surface without much red in the subsoil. It is developed from rocks high in both mica and quartz, probably gneiss.

I am told that in this district there is about one head of cattle for each 1½ hectares of land. This is ridiculous. Of course, much of the area must also be used for food crops, roads, etc. And there are nearly as many sheep and goats as there are cattle. But probably in case of drought or calamity, the King and the nobles would save the cattle before they would save the peasants. At current prices, a peasant wife costs about two head of cattle, whereas a princess requires 10.

At about four o'clock we leave the station and go to see the King at Nyanza. His name is Rudahigwa, or Mutara, which means "King" in the native language. Of course, this black monarch is King only of Ruanda. There is another King of Urundi at Kitega.

We go to the home of the District Governor. Soon the King comes in to discuss arrangements briefly. He is considerably above 6 feet and a little ungainly in appearance. In a few minutes we are driven out to a special court where a large group of dancers put on a demonstration of their art. They wear special costumes, including plumed helmets and little bells on their ankles. They dance with great vigor.

The soil here is strongly rolling and has a dark gray-
ish surface without much red in the subsoil. It is developed
from rocks high in both mica and quartz, probably gneiss.

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head of cattle for each 1½ hectares of land. This is ridicu-
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requires 10.

At about four o'clock we leave the station and go to
see the King at Mya'nsa. His name is Rudahigwa, or Mutara,
which means "King" in the native language. Of course, this
black monarch is King only of Ruanda. There is another King
of Urundi at Kitega.

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King comes in to discuss arrangements briefly. He is consid-
erably above 6 feet and a little ungainly in appearance.
In a few minutes we are driven out to a special court where
a large group of dancers put on a demonstration of their art.
They wear special costumes, including plumed helmets and
little bells on their ankles. They dance with great vigor.

The bells keep coming off and the people dart in from the side to reclaim them. This dance is accompanied by native music, with mostly drums in the orchestra, and much shouting.

I see no native women among the dancers or the spectators.

I am told that the women of the nobility go out almost not at all except to mass or to see a physician.

Then I'm given a demonstration of high-jumping. The King's athletes jump from a little mound about 12 inches high and 25 inches in diameter. They run up to the high jump and put their foot on the edge of this mound about 6 or 7 inches above the general level. The high jumpers stop when they reach about 2 meters and 30 centimeters.

After the dance I have a long talk with the King about this serious problem of too many poor cattle and the hazard of erosion. I explain to him that unless the cattle are reduced soil erosion will increase and the cattle will finally be reduced by starvation. I suggest that he, as King, might influence the people to want high quality cattle and deemphasize the numbers. Of course, he agrees, but I doubt that anything will be done. The Governor raises all kinds of administrative problems. Of course, it is a difficult problem; and I suggest that is what administrators are for. Formerly, the King of Ruanda owned all the cattle that were born in his

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K-1413 June 16, 1947
Ruanda. Nya'nza. Dancers at court of King of Ruanda, just leaving after performance. (Late evening.)

K-1113

14-3

K-1113 June 16, 1917
Ruanda. Mya'mra. Dancers at court of King of Ruanda, just leaving after performance. (Late evening.)

kingdom -- at least theoretically. But this King has given up that right. The King explains that the difficulty is with the poorer nobility who rent their cattle to the peasants. That rent is their only source of income. He claims that the chiefs are convinced of the need for reducing the cattle, but the problem is what to do with those who have only a few cattle as their only source of income.

We drive back to the hotel in the dark for a late dinner.

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We drive back to the hotel in the dark for a late dinner.

June 17: Astrida to Usumbura[a] (in Urundi)

We leave Astrida at about 7:30. I notice that the small businesses dealing with the natives are operated by Arabs. On the edge of town we pass through a splendid forest arboretum with large plantings of adapted native and introduced trees. As we go south, serious erosion is to be seen here and there. Its control is simply a matter of extending the terrace program on the sloping areas and tree planting on the critical places, just as has been done in many instances. All along here food crops are grown in the lowland areas in small raised beds.

Ten kilometers below Astrida food crops make up about one-half of the area -- principally bananas, grain sorghums, and cassava. There is some forest and the rest is pasture. I see some large hillsides newly laid out in proper strips. In other places the natives are following the old method with small plots and rows running up and down the hillside. On slopes over 25 percent, there is obvious sheet and rill erosion.

Some gullies are beginning, especially along the cattle trails that lead down the slopes to water. Others have been started from road culverts and side ditches that have not been properly protected. The erosion problem here is entirely manageable if proper action can be taken soon. Some land must be planted to trees to prevent further deepening of gullies and

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[a] The elevation is about 2625 feet and the rainfall about 34 inches. (The land between is much higher and rainier.)

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K-1414 June 17, 1947
Ruanda. About 3 kilometers south of Astrida. Serious erosion, a little extreme but not uncommon on strongly rolling dark reddish-brown soil with red "B" from mixed igneous rocks. Note raised beds for food crops in lowland.

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the spreading of bare spots on the steep slopes. If the overgrazing is allowed to continue, much land will become useless for crops or pasture until restored by forest over a period of several years. Fortunately, the soil is generally deep even on the strong slopes so that regeneration is quite possible.

As we continue south, there is gradually less rainfall and erosion becomes more serious. But the soil is productive where properly managed. Along with the food crops there are a few small plantings of coffee.

At 30 kilometers south of Astrida, just above the Akanyaru River, I look at a strongly rolling red soil from schist on a slope of about 80 percent.

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Soil Profile Sample No. 29

A_{1-P}	0 - 7"	Dark brown irregularly granular clay loam; many root holes. Reddish-brown when dry.
A_3	7 - 14"	Slightly reddish, dark brown clay loam; somewhat firm, but easily friable. Light reddish-brown to pink when dry.
B_1	14 - 38"	Reddish-brown clay; digs out in medium subangular nut; fairly firm in place, but easily friable. Reddish-yellow when dry. Gradually changes to:
B_2	38 - 65"	Red clay; digs out in easily friable angular nut. Reddish-yellow to pink when dry.
B_3	65 - 100"(variable)	Gravelly and stony red clay; firm in place; very hard when dry and quite plastic when wet. Reddish-yellow to pink when dry. Gradually merges to:
C	100 - 275" plus (variable)	Pink and olive green weathered schist; mottled with light gray and streaked and mottled with brown; soft and friable but stands in nearly vertical cuts like loess.
D	Exposed at 200" and more	Schist

The soil varies greatly in the thickness of the B_3. There are a few nearly vertical veins or weathered quartz and schist in the same cut. Schist rocks vary in texture and color and one cannot be sure that the C came from the D. This soil was undoubtedly developed under forest. Good food crops can be grown up to 50 percent slope where the land is carefully managed. There is considerable erosion on overgrazed pastures above 50 percent slope.

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Table 4. Analyses of Red Latosol. (29)

Sample No.	Horizon	Depth	pH	Organic ~~Matter~~ Carbon	Size Class and Diameter of Particles (*in mm.*)							Other Classes (*in mm.*)		
					Very course sand 2–1	Coarse sand, 1–0.5	Medium sand, 0.5–0.25	Fine sand, 0.25–0.1	Very fine sand, 0.1–0.05	Silt, 0.05–0.002	Clay, <0.002	0.02–0.002	<0.005	>2
		Inches		*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
48772	A_{1-p}	0-7	4.8	2.8	6.8	8.7	8.4	15.1	5.4	17.2	38.4	11.2	42.4	10
773	A_3	7-14	4.4	1.5	5.1	7.0	6.6	12.4	5.8	17.9	45.2	12.3	49.9	1
774	B_1	14-38	4.3	0.7	2.4	4.8	4.6	8.4	4.2	28.5	47.1	8.5	50.3	<0.5
775	B_2	38-65	4.4	0.6	2.2	4.9	5.0	9.4	5.0	16.5	57.0	6.0	61.2	1
776	B_3	65-100	4.5	0.4	7.0	6.4	4.7	7.7	4.0	12.4	57.8	14.7	60.9	43
777	C	100-275	4.6	<0.1	8.4	15.9	10.4	19.6	11.8	23.4	10.5	16.7	15.4	5

Sample No.	Horizon	Depth	Exchangeable Cations me/100 g					Sum of Cations me/100 g	% Base Saturation	Thermal Analysis Data Particle Size Analyzed	Minerals Present Kaolinite ~~Type~~ %
			Ca	Mg	Mn	K	H				
48772	A_{1-p}	0-7	1.7	1.0	0.14	0.2	15.0	18.0	17	<2μ	60
773	A_3	7-14	0.5	0.5	0.04	0.1	15.4	16.5	7		
774	B_1	14-38	0.3	0.1	0.01	0.1	12.6	13.1	4		
775	B_2	38-65	0.2	0.2	0.01	0.1	11.8	12.3	4	<2μ	65
776	B_3	65-100	0.3	0.1	<0.01	0.1	12.2	12.7	4		
777	C	100-275	0.4	0.4	<0.01	0.1	4.5	5.4	17		

Congo Soil Profile No. 29

U. S. GOVERNMENT PRINTING OFFICE 16—46512-2

Congo Soil Profile No. 29

Series & No.	Horizon	Depth	pH	Organic Carbon	Exchangeable Cations me/100 g				Size Class and Diameter of Particles (in mm.)								Thermal Analysis Data — Mineral Particle Size Analysis Treated with Hydrogen Peroxide			
					Ca	Mg	K	H	Very coarse sand 2-1	Coarse sand 1-0.5	Medium sand 0.5-0.25	Fine sand 0.25-0.1	Very fine sand 0.1-0.05	Silt 0.05-0.002	Clay <0.002	0.02-0.002	<0.002	>2		
									pct.	pct.	pct.	pct.	pct.	pct.	pct.	pct.	pct.	pct.		
4873	A1	0-7	4.8	1.0	0.1	0.0	0.0	4.6	3.8	8.1	8.4	15.1	5.4	17.3	38.4	11.3	42.4	10		
4874	A3	7-18	4.4	0.7	0.0	0.0	0.0	3.6	2.1	0.7	6.6	14.4	8.8	17.3	42.3	12.3	43.3	1		
4875	B1	18-38	4.3	0.6	0.0	0.0	0.0	3.4	4.2	4.8	4.6	8.4	3.4	28.3	47.1	6.3	20.2	<0.5		
4876	B2	38-62	4.4	0.4	0.0	0.0	0.0	3.4	5.5	4.9	5.0	3.4	5.0	15.4	27.0	6.0	61.3	1		
4877	B3	62-100	4.5	0.4	0.0	0.0	0.0	3.4	6.0	4.3	4.9	7.7	4.0	12.4	27.8	14.7	60.3	5		
4878	C	100-152	4.6	<0.1	0.0	0.0	0.0	3.4	3.4	12.3	10.4	13.9	11.8	25.4	10.5	15.7	15.4			

Sum of Cations Base Saturation

Exchangeable Cations me/100 g H

Particle Size Analysis Treated with Hydrogen Peroxide

Thermal Analysis Data

Size Classes and Diameter of Particles (in mm.)

Horizon

Depth

pH

Organic Carbon

Exchangeable Cations me/100 g

Very coarse sand 2-1

Coarse sand 1-0.5

Medium sand 0.5-0.25

Fine sand 0.25-0.1

Very fine sand 0.1-0.05

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Series & No.

10—48913-2 PRINTED IN U.S.A. U.S. DEPARTMENT OF AGRICULTURE

Getting this sample was a real job. The cut is fresh because workers are widening the road at this point. I climb up the face of the cut on steps cut into the soil material. The measurements of the horizons are along the slope, but it is so nearly vertical that they are sufficiently accurate.

We cross the Akanyaru River into Urundi. Here I see a large number of natives preparing the alluvial bottoms for cultivated crops. This is very hard work. The soil is moist and sticky and must be carefully worked over deeply in order to remove the grass roots. It would seem that the whole village is at it now in the beginning of the dry season. The soil is worked up into small beds and the intervening ditches are partly for irrigation and partly for drainage. The soils are dark gray over gray clay or clay loam.

A great many of the people here wear brown clothes made from the bark of the Ficus tree. Most have some sort of short skirt and many wear an upper garment too.

Generally, the soils are strongly rolling to hilly, brown and red over schist, with patches of the dark gray soil previously described south of Rulindo. There is some serious erosion, but not so much as near Astrida.

It begins to rain.

The soil in some of the road cuts 10 to 15 kilometers below the river crossing is darker red than sample No. 29. This soil

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It begins to rain.

The soil in some of the road cuts 10 to 15 kilometers below the river crossing is darker red than sample No. 29. This soil

may be slightly better, but it is more important that there are fewer cattle and a higher percentage of food crops and tree plantings. But here improvements are needed, especially on the critical slopes over 35 to 60 percent, depending on their shape. In this region the shape of the slope is exceedingly important -- more so than its length.

I see patches of citrus, cinchona, Eucalyptus, Ficus, and other trees along the road and in critical places on the slopes. The crops are mostly bananas, cassava, beans, peas, and sweet potatoes, with some castor beans, maize, and grain sorghums. This is nice looking country at 20 kilometers below the river crossing.

We pass the Kayanza village 23 kilometers below the river crossing and visit a native chief -- Baranyaka. First we pass his large coffee plantation which is very well maintained without shade. It is on deep, dark reddish-brown soil. Near his home he has a beautiful flower garden. This chief is a fine looking man. His clothes are obviously made by the best London tailors in the European manner. He invites us in for coffee. His house is nicely furnished according to European taste with pictures, cut flowers on the tables, etc. He is a good farmer and sets a fine example for his people. Frequently, he gives talks and demonstrations on terracing and other cultural practices for efficient production and for

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conservation. He keenly realizes the importance of reducing the number of cattle. Good progress has been made in his chiefdom; now there are 100,000 people and only 1,010 head of cattle. About one-half of these belong to him. He is improving his herd by discarding those with long horns and the low milk producers. The chief income of the people here comes from coffee and food crops, especially maize, peas, and beans for the nearby tin and gold mines. They also sell some castor oil.

He says that the ordinary peasant family might have 800 to 1,000 francs (now 43.5 to the dollar) from coffee, 500 francs from food crops, and some additional money from working on the highways and other jobs. But he emphasizes that the good farmers have no spare time for these other jobs.

The chief is growing some pome fruits -- apples, peaches, and plums -- with fair success.

He has 15 children (from one wife - He is a Christian). His sons all go to the school that I visited yesterday in Astrida. Two have graduated and one is already a chief in another district.

I am very much impressed with this man and the enormous influence that he can have in the community. A great deal of his success is due to the wisdom of the former European Governor (a Belgian) who recognized his ability and gave him great encouragement. In fact, the two became great friends,

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even though this chief cannot speak French. Of course he is exceptional. But one man like this can do much more than many European advisors.

I go out and look at his coffee which is now being picked. The trees are about 7 to 10 feet high and very fruitful. The whole plantation is kept well mulched.

Beyond Kayanza the crops are like those just seen. The soils are like samples Nos. 28 and 29. At about 5 kilometers, the relief is a little less bold but still strongly rolling to hilly. I see many new modern terraces.

At 10 kilometers there is again considerable grain sorghum along with bananas, sweet potatoes, beans, some maize, a little coffee, and some cassava. A very high percentage of the land is cultivated and there is only a little fallow. The terraces are protected with pennisetum grass. The natives have some goats, but only a few cattle. There are only a few trees along the road, in small clumps of 3 to a dozen, and in bigger plantings in some of the critical places. There must have been an active terracing program here by the chief or someone else. There are many new ones, some of which have been built very recently. There are very few rock outcrops in this hilly country.

I am continually impressed here with how very hard the people work, especially to prepare these wet alluvial soils for

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food crops. I take a photograph of this operation in a rather broad place in one of the wet dark brown alluvial clay bottoms 22 kilometers south of Kayanza. Men, women, and children are all out working with heavy broad-bladed hoes.

A lot of work is being done on this highway. In making the grade, all the earth is carried in baskets on the head. Wheelbarrows were once introduced but the natives simply picked up the wheelbarrows and carried them on their heads rather than roll them. It is also interesting that these natives like to work very close together. When cutting into a bank they work so near one another that I scarcely see how they avoid hitting one another. The surface metal of crushed rock is also being made by hand. Small stones are placed within woven fiber rings on a large stone and smashed by hand with a hammer.

At 28 kilometers from the village the relief is somewhat bolder again. There is more pasture, some of it quite shrubby, and more trees -- but not enough. Perhaps one-fifth of the land is cultivated. There are several little groves of coffee. All along I see small patches of perfume plants and other specialties.

We pass a butter-making plant run by a European who buys milk from the natives.

On bold hills to the west are some remains of the original forest on the sides of very steep peaks.

food crops. I take a photograph of this operation in a rather broad place in one of the wet dark brown alluvial clay bottoms 22 kilometers south of Kayanza. Men, women, and children are all out working with heavy broad-bladed hoes.

A lot of work is being done on this highway. In making the grade, all the earth is carried in baskets on the head. Wheelbarrows were once introduced but the natives simply picked up the wheelbarrows and carried them on their heads rather than roll them. It is also interesting that these natives like to work very close together. When cutting into a bank they work so near one another that I scarcely see how they avoid hitting one another. The surface metal of crushed rock is also being made by hand. Small stones are placed within woven fiber rings on a large stone and smashed by hand with a hammer.

At 28 kilometers from the village the relief is somewhat bolder again. There is more pasture, some of it quite shrubby, and more trees -- but not enough. Perhaps one-fifth of the land is cultivated. There are several little groves of coffee. All along I see small patches of perfume plants and other specialties.

We pass a butter-making plant run by a European who buys milk from the natives. On bold hills to the west are some remains of the original forest on the sides of very steep peaks.

K-1415 June 17, 1947
Urundi. About 22 kilometers south of Kayanza. View of a broad place in wet dark brown alluvial clay being prepared for food crops now at beginning of dry season. Worked very deeply to remove all grass roots and made into beds for taro and other crops. Water controlled at optimum level by little dams between beds.

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Water controlled at optimum level by little
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At 35 kilometers our road is high and there is less grain sorghum. Some of the upper slopes and "noses" between the dales are rocky. Rocks are still mainly schist of various textures and colors, with red soils. The road is extremely winding. As we descend to the Ruvuvu River, it becomes noticeably warmer. After we cross the river and start to climb, grain sorghums are quite important on the lower slopes.

We pass the road crossing to Muramvia about 12:30. The soils and crops are about like those that have gone before. The rocks are mainly schist with strongly rolling to hilly reddish-brown and red soils with a few purplish-red. Some have lateritic concretions and lateritic hardpans. About one-third to one-half of the land is cultivated. There is a little erosion in spots. Again I see high hills to the west with some of the original forest.

The people here wear more clothing, including even the small children. These are mostly loose-fitting blankets from bark, cotton, or wool. It is rather cool here in the upland and these are worn more for warmth than for modesty. Many have blanket capes with nothing underneath.

In the higher places I see some wheat. There are also small coffee plantings, but the land is a little too high for the best results. As we go up over the last ridge there are a

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few crops and a large percentage of shrubby pasture.

I look at the soil under the original high forest about 12 kilometers beyond the road crossing to Muramvia. We first look at it in several places along the road but have difficulty in finding a place where it can be seen in depth. Everywhere the surface is a deep black heavy fine sandy loam.

A_0	1½ - 0"	Brown mat of partially decomposed leaves, wood, and roots.
A_{10}	0 - 15"	Black loose mellow fine sandy loam with a few grains of white sand.
A_{11}	15 - 23"	Slightly compact but very easily friable to soft crumb, black fine sandy loam.
A_3	23 - 32"	Transitional. Very dark brown fine sandy loam; slightly compact, but easily friable to soft crumb.
B_1	32 - 38"	Like the above but dark brown. (May be absent)
B_2	38 - 50" plus	Very dark gray to nearly black compact fine sandy loam; easily friable. (Little suggestion of the B of the Podzol.)

Added later from a deep road cut:

B_3	50 - 100"	Dark red material from schist.
C	100" plus	Reddish-brown material from schist.

This profile was looked at in the middle part on a long slope of about 7 to 10 percent. Roots penetrate the whole soil easily, but are concentrated in the A. I am not sure what this profile should be called genetically--possibly a "Black Forest" soil if there is such a thing.

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We are soon out of the forest and pass through a large native pyrethrum plantation where insecticides are grown for the native coffee. The soil is very dark brown to nearly black. Here the parent material is reddish-brown, weathered, fine-grained, somewhat metamorphosed granite.

As we go closer to the Rift Valley the mountains become a geological museum with various kinds of schist, granites, and diorites, and I suspect some volcanics. The land is very strongly rolling to hilly and about one-quarter to one-third cultivated. Here peas are the main crop. There is a good deal of shrubby pasture. There is not much erosion, but some rather serious slips. The road is extremely winding. We pass some very rugged hills with the deep black soil over dark reddish brown.

At 32 kilometers some bananas, beans, and sweet potatoes appear as well as peas, and there are quite a few little coffee plantings. Perhaps one-third to one-half of the land is cultivated. The steep peaks are in pasture. The soils are dark reddish-brown over red. The valleys are sharply V-shaped and the alluvial bottoms extremely narrow.

At 40 kilometers we are descending rapidly on a very winding road. The soil is a deep strong red with heavy clay in the B. There are bananas, coffee, cassava, and sweet potatoes. I see a few goats, but only very few cattle.

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Nearly all the people in this hilly country since Goma carry small poles or spears with them. I suppose it helps in walking. Many here are dressed as shepherds according to the "typical" pictures of shepherds.

It gets much warmer as we descend and at 27 kilometers some oil palm appears. As we go over the last ridges, we can look down the valley to the west and see the enormous plain of the Ruzizi River. At 56 kilometers we see Lake Tanganyika and start down the escarpment to Usumbura. It gets hotter and drier every minute. These slopes have reddish-brown soil over schist, mainly. There are crops of cassava, citrus, and bananas with savanna in the intervening places. As we get near the bottom we drive over a large gravelly fan. Cotton appears near the edge of the plain. Down in the plain the crops are mostly cotton and cassava.

The town of Usumbura is located on brown sandy and gravelly loam soils of the delta in the Ruzizi plain.

We arrive in time to go to the Post Office. I mail films back to the United States. We make a brief call on the officials in the Agricultural Advisory Service.

After getting established in my room I go over the town looking for some "objects d'art", but don't find any. Many of the shops catering to the natives here are operated by Indians.

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June 18: Usumbura to Costermansville

I am up early and have a little time because some work needs to be done on the car.

Despite the more rigid social system among the blacks, the partly degenerate "nobility", and the excess cattle in some places like Astrida, I got a little better impression of the natives in Ruanda-Urundi than in many parts of the Congo yet visited. It seemed to me that they were somewhat more alert; certainly they work harder. They dress more plainly, as far as color goes, but the women always have some kind of skirt and most wear an upper garment also, except when working hard.

The fundamental problems in the province go back to: (1) the social status of owning cattle, including the marriage dot, and (2) some acceptable useful occupation for the poor nobility -- those ranking below the chiefs of areas.

I am deeply impressed by the excellent work of the Belgians in this territory, including the development of terracing, forest planting, and the introduction of coffee and other crops for native production. Never have I seen agricultural research and advisory service directed more appropriately to the small farmer. But the research with cattle breeding needs some strengthening and reorganization, I should say.

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Now it is time for breakfast. A little before six o'clock it is dark and quiet, and a few minutes after six it is broad daylight and the air is filled with clatter and chatter.

After breakfast we go to call on the Governor General of Ruanda-Urundi, M. Lardinois. We wait in his office for a little while and then learn that he "rests" at home from his travels! He doesn't ask us to see him at his home, so we leave. He passed us yesterday on the road as I was describing the very black soil under the old forest and stopped to chat a moment. Of course, I was quite dirty and he had on a fine spotless white suit. Perhaps he thought . . . (?)

About one-quarter of the stores in a town like this have one or several sewing machines in front on a sort of porch. These are operated by natives. One buys the cloth inside and these tailors make the garments to measure.

I have to go back to the hotel and change for the field since I am "dressed" for the Governor General! It is very hot here now.

At 9:30 a.m. we leave for Costermansville on the road west near the north shore of Lake Tanganyika. There is a rather heavy native population here. At the edge of the city we pass several brick kilns. The natives are growing food crops of maize, cassava, and bananas, along with some oil palm and various vegetables.

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After about 5 kilometers the land is quite sandy. The soil has a brown loamy sand surface with light gray sand beneath. Cassava is about the only crop, and that is not very good.

I look at soil in a pit about 9 kilometers west of Usumbura.

A_p	0 - 6"	Medium-gray coarse sand with only a little organic matter. Tongues of loose A_1 go down as far as 12 inches.
A_3	6 - 12"	Yellowish-gray loose sand.
C_c	12 - 17"	Massive grayish-yellow to light brown sandy hardpan. Irregular in thickness, color, and degree of cementation. I believe it contains calcium carbonate.
C	17" plus	Loose gray stratified sand, coarse sand, and fine gravel.

The land is nearly flat. There are some shells throughout the soil.

Although a poor soil, it is heavily populated.

Three kilometers farther on, we come to some large cotton plantings. The soil is a little browner but still very sandy.

We pass the Ruzizi River and are back again in the Congo. Near the river is a flat grassy plain occasionally flooded. Beyond this is a higher sandy plain with cotton and patches of maize, cassava, sweet potatoes, grain sorghums

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I look at soil in a pit about 9 kilometers west of Usumbura.

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and so on. The cotton is grown in pure stands and is just now being harvested. (The season for cotton here just below the Equator is directly opposite of that in the cotton growing sections just north of the Equator.)/a I am told that the cotton farmers are becoming comparatively wealthy and hire laborers from the mountains to do much of their work.

Four kilometers beyond the river we come into another large wet grassy plain of dark brown to nearly black soil over mottled stratified fine sand and fine sandy clay. This is used some for cattle grazing. This area is sometimes flooded, especially during periods of cloudy weather when the normal evaporation from Lake Tanganyika is much reduced. The land is barely above the level of the lake.

In another six kilometers we are back on the low sandy soil with poor food crops and many native huts. This continues almost to the mountains. We turn north on the delta strip of lowland. The slopes of the hills to the west are grassy with some shrubs. Most of them are dry, steep, and rocky, but a few patches are arable for food crops. The soils on some of the low fans are good dark brown sandy and gravelly loams. Along the road there are a few scattered trees,

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including acacia, Euphorbia, and Eucalyptus. The crops are cassava, sweet potatoes, cotton, a little maize, scattered palm oil, and bananas in favored places. There are many huts and many people along the road. Far to the east in the plains, I can see large pastures.

About 12 kilometers north of the lake, the road is in the foothills. Mostly I see reddish-brown lithosolic soil from schist and various igneous rocks. Most of it is stony and used for cattle grazing. But in a few coves there is deep reddish-brown local alluvium arable for food crops.

The road is very winding and at 15 kilometers we stop for a flat tire near the Kiliba River. Farther north we pass a series of old fans. The soils vary greatly in texture and in color from light to very dark reddish-brown. Much of the land is idle, partly because it is too dry, although cotton does quite well. Most of the cover is grass 1 to 3 feet tall with scattered acacia and Euphorbia. I see no lime zone or "croûte calcaire".

Here again I am impressed with the enormous loads of firewood these native women can carry on their backs with a head band.

For quite a distance cotton and cassava are the only important crops.

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Then for some distance we are on higher land, old fans and terraces with dark brown sandy loam soils. Some of these soils are gravelly. There is a good deal of idle land and land only partly used for pasture. The principal crops are cotton and cassava.

Then at 50 kilometers we cross another one of these narrow good alluvial valleys with food crops. There are some food crops and fair cotton along here. In places I see a good many cattle. Cassava does not do well on these dry sandy fans and the good food crops are on the strips of moist alluvial soil.

At 67 kilometers we pass a limestone quarry and turn left to the cotton experiment station. After a short distance we drop to a rather wet dark alluvial soil with good cassava. As we go on the soil gradually changes to a dark sandy loam on a low imperfectly drained terrace. There is good cassava and maize.

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On a little higher terrace with a surface of reddish-brown loam or sandy loam, we pass a papaya plantation operated by a European for producing papiorin (?), an ingredient for plastics and chewing gum.

About noon we reach the Cotton Station at Lubarika/a. The Station is built back against the hills on a colluvial fan. There are very steep mountain slopes north and west. These have thin soil with grass and shrub cover. Then there are a few detached hills out in the alluvial fan.

We have a long wait for lunch and then a long lunch with a whole roast pig.

After lunch it is very hot in the sun. First I look at a buried red soil on the edge of the old fan from the mountain slopes. The slope is about 1 to 2 percent. Above the soil the overburden may be described as follows:

(1)	0 - 26"	Mixed, but mostly dark brown very fine sandy loam relatively rich in mica; weak stratification.
(2)	26 - 34"	Dark brown gravelly loam.
(3)	34 - 49"	Dark, slightly reddish, brown fine sandy loam. Massive in place, but vesicular and easily friable to soft crumb.
(4)	49 - 54"	Irregular gravelly loam.

/a The elevation of the plain is about 2900 feet and of the house about 3200 feet. The rainfall is around 45 inches.

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[a] The elevation of the plain is about 2900 feet and of the house about 3200 feet. The rainfall is around 45 inches.

Underneath this overburden the buried soil is as follows:

A_1	0 - 17"	Dark reddish-brown vesicular very fine sandy loam; slightly compact; digs out in coarse blocky pieces that are quite easily friable. The soil has many roots from plants above.
A_3	17 - 30"	Reddish-brown clay loam; massive; when dry, hard and coarsely prismatic; rather easily friable when moist; very few roots.
B_2	30 - 100"	Dark red clay; hard when dry and rather soft and fairly easily friable when moist. There are a few old root channels. In the dry bank there are small cracks for 2 or 3 inches in from the edge. The soil digs out in coarse, roughly prismatic blocks that fall into irregular blocky.
B_3	100 - 110" plus	Like the above but a bit lighter in color, more friable, and with a higher content of fine sand. There are a few buried stones and pebbles of quartz and schist.

I look at another profile nearby where there is no overburden on about the same kind of slope:

A_{1-P}	0 - 7"	Very dark brown very fine sandy loam; easily friable to soft crumb; many roots.
A_3	7 - 15"	Dark reddish-brown clay loam; digs out in irregular blocky; easily friable to soft crumb. The outsides of the gross aggregates are slightly darker in color.

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A_{1-b}	0 - 7"	Very dark brown very fine sandy loam; easily friable to soft crumb; many roots.
A_3	7 - 15"	Dark reddish-brown clay loam; digs out in irregular blocky; easily friable to soft crumb. The outsides of the gross aggregates are slightly darker in color.

B_1	15 - 20"	Dark red fine sandy clay; firm in place, but friable.
B_2	20 - 75"	Dark red clay; firm; digs out in irregular blocky pieces that are fairly easily friable when moist, but hard when dry; vesicular; slight mottling with dark reddish-brown. There are some roots even in the lower part. There seem to be a few soft, incipient, nearly black concretions.
B_3	75 - 85" plus	Red very fine sandy clay; friable when moist.

Nearby in this exposed cut, there is an old grave with burial pottery at three feet and some at six feet. I take a sample of this pottery and of the B_2.

All the horizons in the profile have a nearly orange-red streak from the pick. I am very uncertain about the horizon nomenclature. Perhaps the horizon labeled as B_3 should be regarded as C.

If there is a Laterite soil without a hardpan, or concretions, perhaps this is it.

I go now to look at a productive alluvial soil under a thick stand of pennisetum purpureum (Napiergrass), about 10 feet tall. The land is essentially level with a water table at about 4½ feet.

A_1	0 - 8"	Brown very fine sandy loam mottled with gray and reddish brown; very easily friable.
A_3	8 - 11"	Dark grayish-brown very fine sandy loam finely and brightly mottled with reddish-brown and yellowish-brown; firm, but easily friable.
B	11 - 17"	Very dark grayish-brown silty clay loam finely and brightly mottled with reddish-brown; firm, but easily friable; much fine mica and graphite.

B_3	75 - 85" plus	Red very fine sandy clay; friable when moist.
B_2	20 - 75"	Dark red clay; firm; digs out in irregular blocky pieces that are fairly easily friable when moist, but hard when dry; vesicular; slight mottling with dark reddish-brown. There are some roots even in the lower part. There seem to be a few soft, incipient, nearly black concretions.
B_1	15 - 20"	Dark red fine sandy clay; firm in place, but friable.

Nearby in this exposed cut, there is an old grave with burial pottery at three feet and some at six feet. I take a sample of this pottery and of the B_3.

All the horizons in the profile have a nearly orange-red streak from the pick. I am very uncertain about the horizon nomenclature. Perhaps the horizon labeled as B_3 should be regarded as C. coarse, roughly

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A_3	8 - 11"	Dark grayish-brown very fine sandy loam finely and brightly mottled with reddish-brown and yellowish-brown; firm, but easily friable.
B	11 - 17"	Very dark grayish-brown silty clay loam finely and brightly mottled with reddish-brown; firm, but easily friable; much fine mica and graphite.

G_1	17 - 24"	Dark brown silty clay loam mottled with dark reddish-brown and yellow; compact, but easily friable.
G_2	24 - 40"	Coarsely mottled grayish-brown, brown, and reddish-brown silty clay loam; easily friable.
C	40 - 80" plus	Mottled dark grayish-brown and dark brown wet silty clay loam. The material is very rich in fine mica and graphite.

This is regarded as a productive soil for cotton. It is the first one I have seen with so much graphite in it. I am told that there are many graphite schists in the mountains. Ordinarily the tall pennisetum is cut in October and then again in December. Narrow furrows are plowed and the cotton planted near the beginning of the year. After one year of cotton the land goes back to fallow under pennisetum. The cotton looks good now. I am told that there are many areas of this good soil along the Ruzizi River.

This station will soon be expanded to include work in forestry, and perhaps later in irrigation. Director Jurion thinks this is the best soil in the Congo for cotton. But most of the cotton I have seen has been growing on better-drained soil than that just described. But, of course, our route lies along the edge of the Ruzizi plain and I don't see the main internal body of it.

We leave the station at four o'clock and I look at the soil in the lime stone quarry back by the main road.

G_1	17 - 24"	Dark brown silty clay loam mottled with dark reddish-brown and yellow; compact, but easily friable.
G_2	24 - 40"	Coarsely mottled grayish-brown, brown, and reddish-brown silty clay loam; easily friable.
C	40 - 80" plus	Mottled dark grayish-brown and dark brown wet silty clay loam. The material is very rich in fine mica and graphite.

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We leave the station at four o'clock and I look at the soil in the lime stone quarry back by the main road.

This soil is on a low smooth hill in the plain. The slope is about 2½ percent. The cover is savanna with a few shrubs and trees.

Soil Profile Sample No. 30

A_1	0 - 10"	Nearly black clay; fine hard angular nut structure when dry; many grass roots. To dark red when dry.
B_2	10 - 23"	Very dark reddish-brown clay; coarsely blocky, but easily falls into very hard angular nut. The boundary to C_1 is very sharp.
C_1	23 - 40"	Reddish-brown gravelly clay.
C_2	40 - 75"	Reddish-brown clay mixed with limestone fragments.
D	75" plus	Cracked limestone.

It is possible that part of the solum has developed from material other than the limestone, but I doubt it. This soil is the nearest of anything I have seen developed from limestone in the Congo.

We drive on rapidly (sic) to Costermansville. We cross the low imperfectly drained alluvial plain with cotton and grass fallow. Some marshy spots are now too wet for cultivation. Here they get about 1 ton of seed cotton per hectare and this will run about 35 to 37 percent lint.

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Soil Profile Sample No. 30

A_1	0 - 10"	Nearly black clay; fine hard angular nut structure when dry; many grass roots. To dark red when dry.
B_2	10 - 23"	Very dark reddish-brown clay; coarsely blocky, but easily falls into very hard angular nut. The boundary to C_1 is very sharp.
C_1	23 - 40"	Reddish-brown gravelly clay.
C_2	40 - 75"	Reddish-brown clay mixed with limestone fragments.
D	75" plus	Cracked limestone.

It is possible that part of the solum has developed from material other than the limestone, but I doubt it. This soil is the nearest of anything I have seen developed from limestone in the Congo.

We drive on rapidly (*sic*) to Costermansville. We cross the low imperfectly drained alluvial plain with cotton and grass fallow. Some marshy spots are now too wet for cultivation. Here they get about 1 ton of seed cotton per hectare and this will run about 35 to 37 percent lint.

Table 25. Analyses of Latosolic Rendzina. (30)

Sample No.	Horizon	Depth	pH	Organic Matter Carbon	Size Class and Diameter of Particles (in mm.)							Other Classes (in mm.)		
					Very coarse sand 2–1	Coarse sand, 1–0.5	Medium sand, 0.5–0.25	Fine sand, 0.25–0.1	Very fine sand, 0.1–0.05	Silt, 0.05–0.002	Clay, <0.002	0.02–0.002	<0.005	>2
		Inches		Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
48779	A_1	0–10	7.1	3.1	0.8	2.2	3.2	13.5	12.0	20.7	47.6	9.8	51.0	< 0.5
780	B_2	10–23	7.4	1.9	1.1	1.6	1.8	7.6	6.4	21.0	60.5	11.4	64.0	< 0.5
781	B_3	23–40	7.8	1.4	2.1	1.3	1.4	5.5	5.4	20.2	64.1	13.3	68.6	0
782	C	40–75	7.9	0.4	15.5	6.1	1.9	4.6	10.6	21.5	39.8	15.9	44.9	0

Sample No.	Horizon	Depth	Exchangeable Cations me/100 g					Sum of Cations me/100 g	% Base Saturation	Thermal Analysis Data: Particle Size Analyzed	Minerals Present: Kaolinite	Minerals Present: Montmorillonite
			Ca	Mg	Mn	K	H					
		Inches									Pct.	
48779	A_1	0–10	20.5	13.2	0.05	0.5	6.0	40.2	85	< 2μ	20	Present
780	B_2	10–23	24.5	14.2	0.02	0.5	4.8	44.0	89	< 2μ	20	Present
781	B_3	23–40	32.2	12.0	< 0.01	1.1	1.7	47.0	96	< 50μ	20	Present
782	C	40–75	24.4	15.1	0.01	0.8	0.0	38.3	100			

Conco Soil Profile No. 30

U. S. GOVERNMENT PRINTING OFFICE 16—48572-2

Congo Soil Profile No. 50

Size Class and Diameter of Particles (in mm.)

Sample No.	Horizon	Depth Inches	pH	Organic Matter Pct.	Very coarse sand 2-1 Pct.	Coarse sand 1-0.5 Pct.	Medium sand 0.5-0.25 Pct.	Fine sand 0.25-0.1 Pct.	Very fine sand 0.1-0.05 Pct.	Silt 0.05-0.002 Pct.	Clay <0.002 Pct.	Organic Matter 0.02-0.002 Pct.	<0.002 Pct.	<2 Pct.
48979	A1	0-10	7.1	2.1	0.8	2.8	3.2	15.3	20.7	21.5	42.6	3.8	31.0	0
780	B21	10-23	7.4	1.3	1.1	1.6	1.8	7.6	21.0	20.8	60.5	11.4	64.0	<0.5
781	B22	23-40	7.8	1.4	0.1	1.1	1.4	5.4	5.4	20.8	64.1	13.8	55.6	0
782	C	40-75	7.9	0.4	1.2	1.6	1.9	4.6	10.6	21.5	39.8	13.3	44.9	0

Exchangeable Cations

	Ca	Mg	K	H	Sum of Cations	Base Saturation
	me/100 g					%
A1	0.05	0.05	0.01	0.0	0.1	2
B21	0.05	0.05	0.01	0.0	0.1	2
B22	0.5	0.2	0.1	0.0	0.8	100
C	0.5	0.2	0.1	0.0	0.8	100

Thermal Analysis Data

Particle Size Analysis Present

Montmorillonite Present

Kaolinite Present

Halloysite Present

Quartz Present

Feldspar Present

Mica Present

Iron Oxide Present

Free Silica Present

Amorphous Material Present

Organic Matter Present

Carbonates Present

Soluble Salts Present

Exchangeable Bases Present

Exchangeable Hydrogen Present

Base Exchange Capacity Present

Base Saturation Present

Degree of Weathering Present

Parent Material Present

Remarks

N° 2. GOVERNMENT PRINTING OFFICE 16—90213-3

Where the road goes, there is a great complex of soils. There are a few hills of hard rock, old dissected terraces of all textures, young terraces, and the immediate flood plains of the streams. Just before we leave the plain there are many good crops, especially of grain sorghums and cassava.

We leave the plain and climb the bold Kamanyola Escarpment. The road up the escarpment is a geological museum of metamorphic and igneous rocks. This is about the hilliest, most winding road I have ever been on. Large sections have only one-way traffic guided across the mountains by a series of signal towers on the peaks. The soils are steep thin rocky lithosols. The cover is mainly grass and shrub, with a few trees in favored places. These mountains are very rugged indeed.

The road makes an effective fire line. The upper parts of the mountains burn and have mostly savanna, while below the road there are few fires and there is mostly forest.

We have miles and miles of this hilly winding road. The only place I have ever been in a car that is as rough would be possibly the road leading east from Yosemite Park, but there wasn't as much of that as there is of this. But anyway, it is cool again.

Here the people belong to the Baniabungu tribe. Even

Where the road goes, there is a great complex of soils. There are a few hills of hard rock, old dissected terraces of all textures, young terraces, and the immediate flood plains of the streams. Just before we leave the plain there are many good crops, especially of grain sorghums and cassava.

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The road makes an effective fire line. The upper parts of the mountains burn and have mostly savanna, while below the road there are few fires and there is mostly forest.

We have miles and miles of this hilly winding road. The only place I have ever been in a car that is as rough would be possibly the road leading east from Yosemite Park, but there wasn't as much of that as there is of this. But anyway, it is cool again.

Here the people belong to the Banisbumgu tribe. Even

as we get near the top the mountains are still very rugged, but here and there are a few small patches of food crops.

At 36 kilometers from Costermansville, the soils are strongly rolling and hilly. There are deep red and reddish-brown ones. In the coves are plantings of cassava, bananas, maize, and sweet potatoes. Here again there is some over-grazing and accelerated erosion. Most of the land is thin, rocky, and steep, yet it is amazing what deep soils one may find here on slopes up to 100 percent.

About 30 kilometers below Costermansville, we enter a considerable valley of gently rolling land with a wet alluvial plain in the middle. Here there is some cinchona and many food crops.

A little farther on the sun goes down behind the hills to the northwest which means it will soon be dark. I see some new terracing and some more overgrazed slopes and erosion. We pass several cinchona plantings and a good many small forest plantings of which more are needed on the critical slopes.

The little valleys here also have little strips of mucky alluvium now being worked into raised beds for planting food crops.

About 13 kilometers south of Costermansville the land is strongly rolling to hilly with many food crops. Although

as we get near the top the mountains are still very rugged, but here and there are a few small patches of food crops.

At 36 kilometers from Oosterwaxville, the soils are strongly rolling and hilly. There are deep red and reddish-brown ones. In the coves are plantings of cassava, bananas, maize, and sweet potatoes. Here again there is some over-grazing and accelerated erosion. Most of the land is thin, rocky, and steep, yet it is amazing what deep soils one may find here on slopes up to 100 percent.

About 30 kilometers below Oosterwaxville, we enter a considerable valley of gently rolling land with a wet alluvial plain in the middle. Here there is some cinchona and many food crops.

A little farther on the sun goes down behind the hills to the northwest which means it will soon be dark. I see some new terracing and some more overgrazed slopes and erosion.

We pass several cinchona plantings and a good many small forest plantings of which more are needed on the critical slopes.

The little valleys here also have little strips of mucky alluvium now being worked into raised beds for planting food crops.

About 13 kilometers south of Oosterwaxville the land is strongly rolling to hilly with many food crops. Although

there is some bad erosion on the steep slopes, many fields are now terraced with the new methods.

We arrive in Costermansville at about 6:20 in complete darkness. We have dinner with M. and Mde. de Brandere and Mr. Hendrickx, Director of the station at Mulungu. We sleep in the guest house at the Governor's home, amidst the odor of fresh paint. Everyone is cleaning up for the Prince Regent.

June 19: Costermansville[a] to Mulungu[b] and the Mulungu Station

I slept until nearly 7:00 this morning!

Costermansville is a beautiful little city built partly on a shoe-shaped peninsula in Lake Kivu. There seems to be a great deal of business activity and new construction going on. Generally this region is high. The elevation of the lake is 4,790 feet. At one time Lake Kivu emptied north into the Nile, but this passage was blocked with lava from the group of volcanoes north of Goma. The lake then found a passage south through the Ruzizi River to Lake Tanganyika and from thence to the Congo.

This year the rainy season lasted one month longer than usual. The dry season is only now beginning.

Most of the land here is strongly rolling to hilly with deep dark reddish-brown soil on the surface and, generally, with red B horizons. There are many areas of thin stony Lithosol from the basalt and other rocks.

We drive out north of Costermansville on the west side of the lake and I look at the soil at about 10 kilometers near the village of Hongo. The original cover might

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/a Elevation about 5,000 feet and rainfall around 55 inches.

/b Elevation about 5,000 to 7,500 feet on the station and rainfall about 60 inches.

Soil Profile Sample No. 31

A_{10}	0 - 1"	Very dark brown loose granular clay loam mulch with some relatively fresh organic matter. Dark reddish-brown when dry.
A_{11}	1 - 9"	Very dark reddish-brown porous clay; digs out in clods that break easily into medium nut aggregates that are friable with difficulty; many macro-pores and roots. Dark reddish-brown to purplish-gray when dry.
B_1	9 - 23"	Reddish-brown clay. When dry it is roughly prismatic in place and falls into hard subangular nut.
B_2	23 - 45"	Somewhat grayish and slightly reddish, dark brown clay; roughly prismatic, but falls rather easily into nut aggregates that are quite hard. A gray efflorescence on the sides of the cracks and large pores is collected in a special sample. Purplish-gray to dark reddish-brown when dry.
B_3	45 - 80" plus	Reddish-brown clay. Digs out in large nut that breaks into medium nut; friable under hard pressure; mottled with dark reddish-brown, orange-yellow, and dark purplish-red. Here there is also a light gray efflorescence on the sides of the cracks.
D	Taken at 50 feet	Dark brown basaltic rock, variable in color and texture. Some is irregularly prismatic; most is not.

Possibly the horizon labeled B_3 should be regarded as C. Roots penetrate to the top of the B_3.

Soil Profile Sample No. 31

A_{10}	0 - 1"	Very dark brown loose granular clay loam mulch with some relatively fresh organic matter. Dark reddish-brown when dry.
A_{11}	1 - 9"	Very dark reddish-brown porous clay; digs out in clods that break easily into medium nut aggregates that are friable with difficulty; many macro-pores and roots. Dark reddish-brown to purplish-gray when dry.
B_1	9 - 23"	Reddish-brown clay. When dry it is roughly prismatic in place and falls into hard subangular nut.
B_2	23 - 45"	Somewhat grayish and slightly reddish, dark brown clay; roughly prismatic, but falls rather easily into nut aggregates that are quite hard. A gray efflorescence on the sides of the cracks and large pores is collected in a special sample. Purplish-gray to dark reddish-brown when dry.
B_3	45 - 80" plus	Reddish-brown clay. Digs out in large nut that breaks into medium nut; friable under hard pressure; mottled with dark reddish-brown, orange-yellow, and dark purplish-red. Here there is also a light gray efflorescence on the sides of the cracks.
D		Taken at 50 feet Dark brown basaltic rock, variable in color and texture. Some is irregularly prismatic; most is not.

Possibly the horizon labeled B_3 should be regarded as C. Roots penetrate to the top of the B_3.

Table 17. Analyses of Reddish-Brown Latosol. (31)

Sample No.	Horizon	Depth	pH	Organic ~~Matter~~ Carbon	Size Class and Diameter of Particles (*in mm.*)							Other Classes (*in mm.*)		
					Very course sand 2–1	Coarse sand, 1–0.5	Medium sand, 0.5–0.25	Fine sand, 0.25–0.1	Very fine sand, 0.1–0.05	Silt, 0.05–0.002	Clay, <0.002	0.02–0.002	<0.005	>2
		Inches		*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
48784	A_{10}	0-1	4.9	8.4	Not determined		---	---	---	---	---	---	---	---
785	A_{11}	1-9	4.3	3.8	0.3	0.3	0.3	0.9	1.7	20.6	75.9	15.0	80.4	0
786	B_1	9-23	4.9	0.9	0.3	0.6	0.3	1.6	2.2	24.5	70.5	16.0	74.8	0
787	B_2	23-45	4.7	0.4	0.0	0.1	0.4	4.0	4.7	30.4	60.4	22.0	65.5	0
788	B_3	45-80	4.6	0.2	0.0	0.1	0.2	3.8	8.7	36.2	51.0	24.4	56.7	0

Sample No.	Horizon	Depth	Exchangeable Cations me/100 g					Sum of Cations	% Base Saturation
			Ca	Mg	Mn	K	H	me/100 g	
48784	A_{10}	0-1	7.2	3.8	0.47	0.4	25.6	37.5	32
785	A_{11}	1-9	0.7	2.0	0.14	0.1	31.0	33.9	9
786	B_1	9-23	1.0	1.1	0.04	0.1	25.9	28.1	8
787	B_2	23-45	3.2	5.6	0.04	<0.1	31.0	39.8	22
788	B_3	45-80	4.9	7.5	0.06	<0.1	24.9	37.4	33

Sample No.	Horizon	Depth	Total P	Available P
			%	p.p.m.
48784	A_{10}	0-1	.048	28
785	A_{11}	1-9	.261	14
786	B_1	9-23	.197	2
787	B_2	23-45	.122	5

Sample No.	Horizon	Depth	Thermal Analysis Data	Minerals Present	
			Particle Size Analyzed	Kaolinite ~~Type~~ %	Montmorillonite Type %
48784	A_{10}	0-1			
785	A_{11}	1-9	<50μ	60	
786	B_1	9-23			
787	B_2	23-45	<2μ	45	Present
788	B_3	45-80			

~~Congo Soil Profile No. 51~~

U. S. GOVERNMENT PRINTING OFFICE 16—46512-2

Congo Soil Profile No. 51-

Sample No.	Horizon	Depth	Hq.	Organic Matter Carbon	Size Class and Particle Diameters (in mm.) Very coarse sand 2-1	Coarse sand 1-0.5	Medium sand 0.5-0.25	Fine sand 0.25-0.1	Very fine sand 0.1-0.05	Silt 0.05-0.005	Clay <0.005	Other Classes (in mm.) 0.05-0.005	<0.005	>2
				Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
48796	A1	0-7	4.3	5.4	0.3	0.3	0.3	---	1.7	20.5	---	15.0	80.4	0
783	A12	7-23	4.3	3.8	0.3	0.6	0.3	0.6	2.3	24.5	76.0	16.0	74.8	0
784	B1	23-45	4.3	0.9	0.3	0.6	0.4	4.0	4.7	30.4	70.5	22.0	55.5	0
785	B2	45-80	4.8	0.5	0.0	0.1	0.5	3.8	8.7	32.3	61.0	24.4	36.7	0

Mineral Analysis Data

Particle Size Analysis of Minus 2 mm. Fraction

Sample No.	Horizon	Depth	Hq.	Organic Matter Carbon	Very coarse sand 2-1	Coarse sand 1-0.5	Medium sand 0.5-0.25	Fine sand 0.25-0.1	Very fine sand 0.1-0.05	Silt 0.05-0.005	Clay <0.005	<0.005	>2
				Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
48796	A1	0-7	4.3	5.4	0.3	0.3	---	---	---	---	---	---	---
783	A12	7-23	4.3	3.8	0.3	0.6	0.3	0.6	2.3	24.5	76.0	16.0	74.8
784	B1	23-45	4.3	0.9	0.3	0.6	0.4	4.0	4.7	30.4	70.5	22.0	55.5
785	B2	45-80	4.8	0.5	0.0	0.1	0.5	3.8	8.7	32.3	61.0	24.4	36.7

Exchangeable Cations

Special Sample No.	Horizon	pH
48790	B_2	4.8

Gray efflorescence on aggregates.

Congo Soil Profile No. 31

Special Sample No. 4820

Horizon B_{2} pH 8.4

Clay: Horizon is an aggregate of

K-1416 June 19, 1947
Belgian Congo. 10 kilometers northwest of Costermansville. Profile of dark brown lateritic soil from basalt. (Profile sample No. 31.)

K-1416 June 19, 1947
Belgian Congo. 10 kilometers northwest of Costermansville. Profile of dark brown lateritic soil from basalt. (Profile sample No. 31.)

We go on north along the lake. Cassava, maize, grain sorghums, sweet potatoes, bananas, and beans are grown in small patches. There is some erosion on slopes of 50 percent. This is another geological museum with a complicated mixture of volcanic rocks -- basalt, andesite, and what have you.

There is a good deal of tall grass in the fallows. The tiny alluvial bottoms of the short streams from the mountains have very heavy dark reddish-brown clay in the surface.

At 18 kilometers we leave Lake Kivu and turn northwest into the hills with gently and strongly rolling dark reddish-brown soils. The good soils are used mainly for food crops and pasture with cattle. The higher hills are well rounded and have mostly grass with only a few shrubs.

Here the people wear very little clothing indeed, especially the common native men and boys. Those over 12 years have practically nothing but a small loin cloth. The women wear skirts and most of them have some upper garments, except while at work.

At 29 kilometers there is more intensive farming with some cinchona, coffee under the shade of Erythrina, geraniums, etc. I am told that in this region the coffee yields much more if pruned with three or four stems than if trained to a single trunk.

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At 29 kilometers there is more intensive farming with some cinchona, coffee under the shade of Erythrina, geraniums, etc. I am told that in this region the coffee yields much more if pruned with three or four stems than if trained to a single trunk.

Just before 11 o'clock we arrive at the Mulungu Station. This is probably the largest INEAC station except for the main one at Yangambi.

I look at a soil profile from the basalt right near the station headquarters where the elevation is 1,780 meters. This is a shallow soil on a strong slope on the side of the valley. Probably there were once some trees; now the vegetation is grass.

Soil Profile Sample No. 31-A

A_1	0 - 8"	Black clay with well-developed fine granular structure; a few pebbles of basalt; many grass roots.
B	8 - 50" (20-100")	Dark brown clay with irregular nut structure, rather easily friable to crumb; some mottling with orange-yellow. About one-half of the mass is made up of fragments of dark gray basalt. Dark reddish-brown when dry.
C and D	50 - 100" plus	Large boulders and blocks of basalt or basaltic lava with some brown or yellowish-brown rotten rock and soil in the cracks.

Grass roots penetrate easily to the hard rock.

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Grass roots penetrate easily to the hard rock.

I look at another profile where the soil was cultivated and burned for several years and alternately grazed. Recently it has been returned to grass. The slope is about 6 percent.

A_P	0 - 9"	Dark brown clay loam in a mixture of rounded nut and granular; many grass roots.
A_3	9 - 13"	Dark reddish-brown clay loam; roughly prismatic and coarsely blocky; friable to granular with hard pressure.
B_2	14 - 28" (Tongues go to 36")	Reddish-brown clay loam; roughly prismatic that falls into coarse irregular nut; fairly easily friable.
B_3	28 - 56" plus	Brown, massive, easily friable fine sandy clay loam; firm in place, but roots penetrate easily. (Rather "springy" and hard to dig out with a pick.)

Another few feet down the slope I look at a soil that has been under cypress since 1935. The trees are 5 to 12 inches d.b.h. There is essentially no ground cover. This soil has been worked in times past, deeply in spots.

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A_{00}		A very thin covering of needles.
A_0	½ - 0"	Brown needles and roots.
A_1	0 - 6" (5 - 8")	Dark brown clay loam; a mixture of medium nut and granular; nut pieces hard to crush now soil is dry. Dense root growth.
A_3	6 - 9" (8 - 10")	Dark, slightly reddish, brown clay loam; coarsely prismatic which falls into irregular nut that is fairly easily friable.
B_2	9 - 15" (10 - 20")	Very slightly reddish, brown clay loam; fairly easily friable irregular nut with suggestion of prismatic.
B_3	15 - 55" plus	Brown, massive, easily friable fine sandy loam; like B_3 of the previous profile.

The roots are highly concentrated in A_1 but some extend into the B_3.

I am shown another pit nearby. Twelve years ago acacia was planted but died seven years later. Since then the area has been in natural fallow of grass and weeds. The surface has a pronounced micro-relief.

A_{10}	0 - 3"	Dark brown finely granular clay loam; mulch-like and loose.
A_{11}	3 - 7" (6-10")	Very dark brown to almost black granular clay loam; slightly prismatic loose blocks in place.
A_3	7 - 11"(10-13")	Like the above, but a little firmer.
B_2	11 - 23"	Dark reddish-brown clay loam; slightly prismatic, but falls into irregular nut; friable with difficulty.
B_3	23 - 55" plus	Like the last two profiles.

Roots penetrate throughout the soil.

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Roots penetrate throughout the soil.

Then in this area I look at another pit on the same general slope. Like the others, it had savanna with burning and grazing for years. This area has been kept free of fire and grazing for 12 years and now has a dense stand of shrubs, briers, ferns, and small trees.

A_0	½ - 0"	Loose dry brown finely fibrous mat of roots and organic remains.
A_{11}	0 - 2" (½ - 2½")	Dark brown finely granular mulch-like clay loam.
A_{12}	2 - 8"	Very dark brown to black clay loam; blocky nut structure, easily friable to granular; suggestion of prismatic.
A_3	8 - 11" (10-15")	Slightly reddish, dark brown clay loam; blocky nut; fairly easily friable.
B_2	11 - 23"(20-23")	Dark reddish-brown clay loam with irregular nut structure; friable under some pressure; suggestion of prismatic.
B_3	23 - 65" plus	Like the three previous profiles

Some tongues and spots of A_{12} and A_3 are deep in the profile. These may have been caused, in part, by old root channels, or may be the work of insects.

At one o'clock I go to lunch with Directors Jurion and Hendrickx. The director has a very nice home. Just as I enter the house, I am impressed by an inside garden with cacti and other plants opposite the entrance hall.

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A_{00}	$\frac{1}{2}$ - 0"	Loose dry brown finely fibrous mat of roots and organic remains.
A_{11}	0 - 2" ($\frac{1}{2}$ - 2$\frac{1}{2}$")	Dark brown finely granular mulch-like clay loam.
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The first one is developed from basaltic lava at an elevation of about 6,000 feet on a relatively smooth slope of around 6 percent. This area was in cultivated pyrethrum for five years which has been followed by crotalaria for the past 18 months.

A_p	0 - 12" (7-15")	Very dark brown granular clay loam which breaks into easily friable clods.
A_3	12 - 15" (13-17")	Dark brown clay--transitional.
B	15 - 36" (22-36" plus)	Dark yellowish-brown clay; digs out in irregular, easily friable clods; some suggestion of prismatic.
C and D	36" plus	Mass of pebbles and boulders of dark gray hard basaltic lava and dull reddish-brown clay. Roots are concentrated in the A but extend through the B.

I look at another some 50 feet away where the soil has natural fallow instead of crotalaria. The soil is about the same, but the clods are harder and less easily friable in the lower A_p, A_3, and upper B. Very few roots go beyond the upper part of the B. There is much more tendency for prismatic breakage when the soil is dry, as it is now. Thus it appears to be very important to have a good fallow crop rather than natural fallow after pyrethrum.

I look at another profile on this slope a few hundred yards down where the slope is slightly less. This land had 5

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I look at another profile on this slope a few hundred yards down where the slope is slightly less. This land had 5

years of cultivated pyrethrum followed by one year of crotalaria.

A_p	0 - 12"	Very dark brown mellow granular clay loam; tongues go to 24 inches; many roots.
B_1	12 - 15"	Like B_2 but slightly darker.
B_2	15 - 35"	Slightly reddish, brown clay; digs out in clods that fall easily into irregular nut which in turn is fairly easily friable; suggestion of prismatic. The soil has a few fragments of basaltic lava.
C and D	35" plus	A mass of fragments of dark gray basaltic lava and yellowish-brown clay.

There are a good many roots concentrated in A although some go down into the C.

I look at a fourth profile on this general slope very near the last where the crotalaria failed to grow. It was probably killed by the wild plants since the soil is a little more productive. The slope is about 2 percent.

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Soil Profile Sample No. 32

A_{1-P}	0 - 17"	Very dark brown to black granular clay loam; tongues go to 26 inches; many roots. Dark reddish-brown to black when dry.
B_1	17 - 22"	Very dark brown clay; digs out in subangular nut that is friable under hard pressure; slightly prismatic. Dark reddish-brown when dry.
B_2	22 - 40"	Brown to slightly reddish dark brown clay; massive;digs out in weak, easily friable subangular nut. Dark reddish-brown when dry. The soil grades into:
C and D	40 - 60" plus	Dark yellowish-brown friable clay; "springy" when dug with the pick; weak subangular nut; contains fragments of basaltic lava. To dark reddish-brown when dry.

The roots are mainly in A, but many go down into the C and D.

I go back up the slope to a field of pyrethrum lying above the first profile of this group on a slope above 6 percent. The crop has been on this soil six years and is about finished. I am told that six years is too long -- that after $4\frac{1}{2}$ years the soil should go back to fallow. It certainly looks that way to me. The harvest of the pyrethrum blossoms begins six months after planting. The soil is cultivated every 10 days for 10 months in the year (all except for the dry season). In this process all weeds are removed. Then native girls walk up and down the rows to pick the flowers

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I go back up the slope to a field of pyrethrum lying above the first profile of this group on a slope above 6 percent. The crop has been on this soil six years and is about finished. I am told that six years is too long -- that after 4½ years the soil should go back to fallow. It certainly looks that way to me. The harvest of the pyrethrum blossoms begins six months after planting. The soil is cultivated every 10 days for 10 months in the year (all except for the dry season). In this process all weeds are removed. Then native girls walk up and down the rows to pick the flowers

every four or five days. Thus, the soil is exposed directly to the sun and rain for long periods. The soil structure deteriorates badly, especially in the A_3 and B_2. I am told the land cannot be mulched because the pyrethrum will suffer from root rot.

I try to take some pictures of the surface soil. It is either hard from the packing by the barefooted girls and the hot sun, or it is in a loose cindery mass from cultivation.

I examine a profile at 2,060 meters.

A_P	0 - 8" (6-13")	Very dark brown to black granular clay loam. The soil mass is quite loose, but the granules are very hard when dry, as now.
A-B	8 - 16" (15-19")	Very dark brown clay coarsely and irregularly prismatic. The soil falls into subangular blocky fragments that yield under hard pressure to stiff crumb. It is "springy" in place and hard to dig out with the pick.
B_2	16 - 26"	Dark reddish-brown clay; roughly prismatic. Under hard pressure, the large blocks break into somewhat small subangular blocky and some granular. "Springy" and hard to dig with the pick.
B_{21}	26 - 36"	Like above, but more friable.
C and D	36" plus	Reddish-brown clay; generally massive and "springy" but clods are fairly easily friable. There are some fragments of basaltic lava.

There are very few roots below the upper part of A-B.

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K-1417 June 19, 1947
Belgian Congo. At Mulungu. Close view of soil in gap in rows of pyrethrum. Soil cultivated, exposed to sun, and badly tramped by native girls picking the flowers. A bad crop for the soil.

K-1418 June 19, 1947 Belgian Congo
At Mulungu . Pyrethrum on nearly black lateritic soil from basaltic lava. Note that soil is exposed to strong sunlight. It is cultivated a good deal and tramped by native girls harvesting the flowers.

K-1117 June 19, 1917
Belgian Congo. At Mulungu. Close view of soil in gap in rows of pyrethrum. Soil cultivated, exposed to sun, and badly tramped by native girls picking the flowers. A bad crop for the soil.

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I talk a little with one of the staff about the employment of the natives. Those employed here by INEAC get each year one pair of shorts, one blanket (with at least one kilo and 600 grams of wool), one pullover, and one coat or overcoat. In addition, they receive 3½ francs per day and their food. These rations include palm oil, salt, and cassava or banana flour. They did get dried fish at cost, but after today they will have one-half kilo as a ration for themselves plus an allowance for their wife and children. Here the women and children work on a piece-work basis at such things as picking the pyrethrum blossoms and other work. They will earn between 3 and 6 francs a day. They get, for example, one franc for each 5 kilos of pyrethrum blossoms.

Every year each native family gets a new house of the native type, or they may have a permanent brick cabin. After 15 years of service they get a cow.

Later I talk with M. Jurion and he tells me that house boys get somewhat more -- say 200 to 250 francs per month and 30 francs per week for food. At Yangambi the workers get an allowance of 7 francs per week for food for their wives and 4 francs for each child. (But if they have more than one wife they get allowances only for the children.) In addition, they have a garden plot with cassava, bananas, etc. The natives are also given free medical service, including dental extractions.

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I am told that the natives save very little money, if any, but spend it for drink, clothing, meat, and things of that sort.

I go back to the laboratory and lay out the soil samples to dry. By then it is completely dark. I still haven't seen all I should like to see at this station. It is a very large place. There are many experiments with coffee, cinchona, tea, fruits, and food crops -- both breeding experiments and production experiments.

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June 20: With the geologist in Costermansville and near the Mulungu Station

First this morning I tour the laboratories at the Mulungu station. There is a good deal of routine work going on in order to appraise the amount of quinine in cinchona, test seeds, identify insects, identify various pathological organisms of plants, etc. In addition, there is considerable research along some of these lines. The laboratories are quite well equipped. The library is somewhat inadequate and needs expansion.

I am told that several planters in this region are establishing orchards of Montana tung. Tea is increasing as well as other specialties. In part, the planters are trying to find crops to replace pyrethrum since the market for that is declining and the outlook is not good.

Later I am driven to Costermansville in order to visit the Geological Service. An excellent museum is maintained with specimens of a wide variety of rocks and minerals to be found in the Costermansville province. I have a considerable discussion with the present director -- Constantin Sorotchinsky. He explains briefly the current opinions of the geologists regarding the origin of the existing surface geology along the Rift Valley. Presumably, at one time, there was an irregular formation of crystalline rocks, with perhaps graphite

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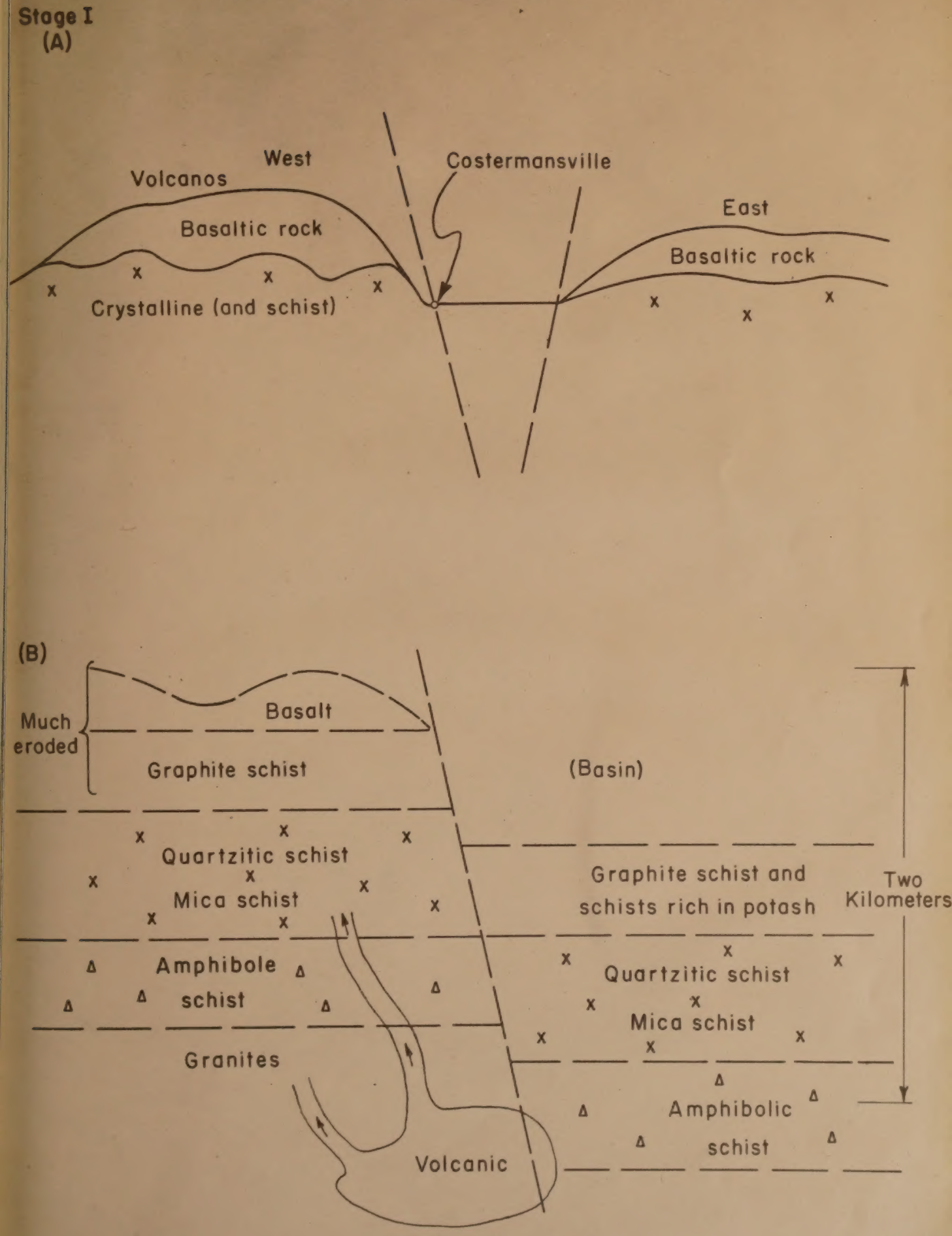
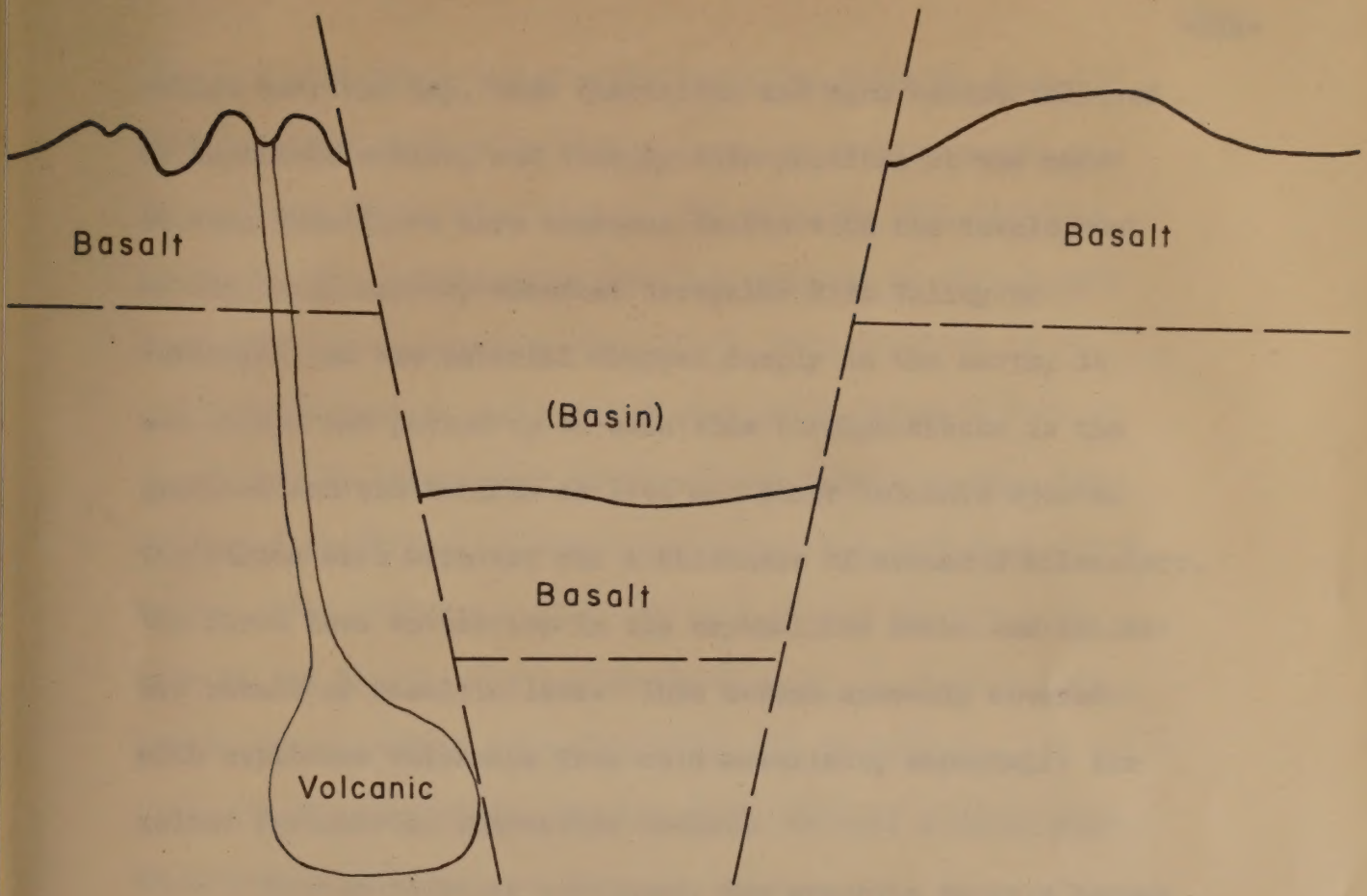
Much simplified sketch of the Rift Valley



This basaltic lava comes up through cracks to cover the whole region.

Stage II

Faulting continues:



Over basaltic lava comes explosive volcanics from acid materials.
(The melted quartzitic schists are Precambrian.)

Stage III.

As faulting continues graphite schists become molten. Quartz porphyries are formed.

In the last stage, a river flowing to the Nile is blocked by lava near Goma to form Lake Kivu, which drains now through the Ruzizi River to Lake Tanganyika and thus to the Congo.

The final product, with erosion, faulting, and so on, is a great geological museum.

schist near the top, then quartzitic and mica schist followed by amphobole schist, and finally with granites at the base. At some time there were enormous faults with the development of the long, narrow, somewhat irregular Rift Valley or "Graben". As the material dropped deeply in the earth, it was melted and pushed up on each side through cracks in the granites and the schists as lava and other volcanic ejecta. The strata were affected for a thickness of around 2 kilometers. The first lava on the top in the crystalline rocks and schist was basalt or basaltic lava. This became unevenly covered with explosive volcanics from acid materials, especially the melted Precambrian quartzitic schist.

Then as faulting continued, the graphite schists became molten and quartz porphyries were formed. In the last stage a river flowing to the Nile was blocked by lava near the present site of Goma. Lake Kivu formed back of this lava dam. This lake now drains through the Ruzizi River to Lake Tanganyika and thus to the Congo. Of course, these faulting lines are irregular and complicated. The volcanic lava and other ejecta have been deposited very unevenly. There are many minor faults. These uneven surfaces of various materials have been further subjected to differential erosion. The final result is, of course, an enormously complicated mountain area on each side of the valley.

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I also pay a brief visit to the Comité Nacional du Kivu and they furnish me with a good and fairly recent geological map of the Kivu region. It would be impossible to imagine a map sufficiently detailed, however, to show all the strikingly contrasting rocks.

I go back to the Mulungu station for lunch.

In the afternoon I am driven out to the northwest by M. Hendericks/a on a one-way road to the Kahuzi Mountain. This is a very winding road. It is open for travel toward the lake in the morning and toward the mountain in the afternoon. In the evening after six o'clock one may go either way.

Just after leaving the station, we pass a large cinchona plantation run by a European manager, who is an official of the Government, for the natives. The land at first is gently to strongly rolling and covered partly by a pasture of shrubs, grass, and weeds, and partly by plots of native food crops.

Near the Langa River I look at a cut about 150 feet deep with dark brown fine sandy loam over thin rotten schist, which, in turn, lies over basalt or basaltic lava. A great deal of work has been done to prepare this profile for me, but the soils are not particularly interesting. The schists are mainly quartzitic, but there are some graphite schists. Near the foot of the slope there are buried soils developed

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from the lava which are now covered with colluvium from the soil developed from schist.

Along the road we see mainly basaltic lava for some distance. At 10 kilometers from the station we pass a very large commercial cinchona plantation, much of which is on rather shallow soil. The plants are badly infested with an insect called Helopeltis, which affects plants at high elevations. At about 13 kilometers there are a good many trees on the upper slopes and near the tops of the canyons. On some of the slopes, ferns grow abundantly. I am told that these ferns indicate soil unsuitable for pyrethrum. The soils from the lava here vary in color from light yellowish-brown to very dark brown.

At about 20 kilometers we stop to look at the soil in a dense bamboo forest. The individual trees are about 3 or 4 inches d.b.h. The slope is 2 to 3 percent. It is a great pity that I only have an opportunity to see the very upper horizons.

A_0	2 - 0"	Mat of brown decomposed leaves, wood, and yellow roots.
A_{10}	0 - 2"	Dark brown silt loam with rounded nut structure, easily friable to soft granular; many roots.
A_{11}	2 - 5"	Dark yellowish-brown silt loam; many roots.
A_2	5 - 15"	Yellowish-brown silt loam; rather firm, but digs out in easily friable clods.

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At 24 kilometers I see a large outcrop of the nearly black graphite schist. At 28 kilometers, after passing through a beautiful forest, I come up on higher, relatively open grassland and shrubland. The high mountain slopes are covered with shrubs and very small trees. I look hurriedly at the soil in the mixture of savanna trees and brush. The surface 12 inches is a black, very softly granular, very fine sandy loam. This lies over red friable very fine sandy clay loam. Deep beneath the soil are volcanic rocks, probably of recent age. In this area the volcanics and the various schists are intimately mixed together.

We stop near the edge of the mountain where the rocks include lava, quartzitic schist, graphite schist, and a great variety of special contacts in an amazing complexity. It is remarkable how deep weathering has gone on many of these slopes, even to make a very fine sandy putty out of hard quartzite.

At six o'clock it is nearly dark and we go back over the same road to the station. M. Hendrickx, M. Jurion, and I have dinner together.

I am impressed with the work they have been able to do on the improvement of sweet potatoes for the natives. The original native varieties gave about 5 tons to the hectare with 9 months of culture. They now get from the improved variety 40 tons per hectare with 6 months of culture. They

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M. Jurion explains that their junior scientists added to the staff get a salary of about 115,000 francs annually, plus medical service and travel for himself and family. They are also furnished a house with furniture and yard boys to take care of the lawns and gardens. At one time INÉAC paid the expenses of a young scientist's fiancée when she came from Brussels to the Congo to be married. They have had to change the regulations, however. Too many times the young lady would meet someone else she liked better on the journey and INÉAC would have no way of getting back the money for the ticket. So now the young scientist and his fiancée need to finance her trip. After they are legally married INÉAC will reimburse them for her travel.

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June 21: Costermansville to Elisabethville

At eight o'clock we leave the station for Costermansville. We call briefly on the Acting Governor and have a few moments for a drive among the many nice homes on the peninsula. All the roads are very dusty now in the dry season. The airport is across the boundary in Urundi so we cross the Ruzizi River. The soil here is a rolling very deep reddish-brown clay loam. There is a good deal of coffee, cinchona, and food crops. Most of the rest of the land is pasture and much of it is overgrazed with some consequent erosion. Like near Astrida, the worst features are the slips which continue to get worse unless arrested by tree planting.

I see several natives bringing in cow's milk for sale. The milk is kept in small earthen jugs. These are cleansed and rinsed with the urine of cows.

At the airport we find that the plane is very crowded; in fact, there is not enough room for everybody. (And we are charged 640 francs for excess baggage). The plane is a two-engined Lockheed for about 14 people.

We are in the air for Usumbura at 11:27. As we leave the airport I see more serious erosion on the overgrazed pastures. It is very important that trees be planted as soon as possible in the critical spots, especially those having slips. We are soon over the very rugged mountains of the

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Kananyola escarpment and then over the plain of the Ruzizi River. Most of the cultivation here is cotton on the good alluvial soil, probably about like that described at the Lubarika station. Cotton and food crops are also grown in favored places on the higher terraces. In places the river has cut through old high fans and has no alluvial soils on the sides. In these places the river is bordered with irregular areas of badlands that are fairly well covered with shrubs.

We are down at Usumbura from 11:53 a.m. to 12:30 p.m. For some distance we fly south over Lake Tanganyika and then turn inland to the southwest over Baie de Burton. The cover is mostly savanna with shrubs, although there are a few thin stands of trees. Marshes border the streams. This area has few people.

We come over the east side of the great Congo plain. The vegetation is mostly savanna and scattered trees, with a few galleries and spots of forest near the Luama River. Beyond, there is more forest in the galleries, but few people. Between the Luama River and the Luilu River there are some well dissected lands with only thin vegetation on the slopes.

Near Katende the land looks to be dry shrubby savanna with thin gallery forests and only a few people. Just before Manono, where we are on land from 2:03 p.m. to 2:41 p.m., the forest is somewhat heavier, but generally thin. This town is

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a large tin-mining center. All about is a large plain with dull brown soil under thin shrubs and trees with savanna. There is very little farming and the soil looks poor. After Kansonge we come again to hilly country with somewhat more forest and perhaps a few more natives. For a long way here I see many prominent dissected ridges running northeast by southwest. These are considerably more bold on their southeastern sides than on their northwestern sides. All along here many savanna fires are to be seen from the plane. Too bad!

In a little while the air becomes very hazy, but I can see that there are somewhat more villages than are shown on the map and certainly a good many more important highways. In the general neighborhood of Tomboka there are large swamps underneath the plane and to the west.

We are down at Elisabethville at 4:30 on a great undulating plain, again with many large termite mounds about 15 feet high and 25 feet in diameter. Here they likely cover not more than 5 to 8 percent of the land area.

We are met at the airport by M. and Mde. Soyer. M. Soyer is in charge of INÉAC's work in this general part of the Congo and Mde. Soyer is a plant pathologist with INÉAC.

After getting established in our hotel we have a very pleasant evening and dinner "chez" Soyer. Although the days are warm, the nights here are very cool -- uncomfortably so after the central Congo. But, of course, I am now on a high plateau nearly a mile high about 12 degrees south of the Equator and in the winter dry season.

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K-1419 June 22, 1947 Belgian Congo.
South of Elisabethville. Nearly level yellow (over red) Ground-Water Laterite. Very dry in winter and wet in summer. Poor pasture. Best soil for crops on termite mounds. This soil better than other types in same group, as indicated by large size of mounds.

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June 22: Sunday in Elisabethville[a]

It is really too cool for a summer suit this morning!

I spend most of the morning completing my various records of travel and soil samples. At noon I go to a fancy luncheon "chez" Quets -- one of the officials of the Union Miniere. Then at about 2:30, I go for a ride in the country.

The natives here, in and near the city, are completely dressed, much like Europeans -- the men somewhat more plainly and the women in gay dresses with brilliantly colored patterns.

Most of the country around the city is nearly flat or only gently undulating. Apparently the native vegetation was a relatively thin, slow-growing forest. Now the wild vegetation is largely savanna, with savanna shrubs and trees. At this time the area is well into the dry season and some of the vegetation is dormant or partially so. There appears to be a rather intimate mixture of soils predominantly gray, yellow, orange-red, and red, with dark-colored soils in the lowlands. Many of these lowlands are practically treeless. Locally, such treeless areas are called "dembos". Here and there I see many conspicuous termite mounds several feet in diameter and several feet high. They probably cover 1 to 8 percent of the area. These seem to be most conspicuous on the orange-red soil. In this area the soil on the termite

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[a] Elevation about 4,050 feet and rainfall about 47.5 inches.

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mounds is much better for crops than the other soil. The native vegetation does better and some species are confined to them. The natives grow maize and similar crops on the tops of these mounds. Such maize is planted during the rainy season so that it will mature at the beginning of the dry season. Most of it has just been harvested.

Since the soils contain concretions and sometimes quartz fragments, the material in the termite mounds is the best available for making bricks.

I stop by an old mine pit in nearly flat country. The surface horizon of 8 to 10 inches is dark grayish-brown powdery silt loam or silty clay loam. This is underlain by bright yellow soil a little firm in place but easily friable. This contains lateritic concretions. Beneath, there is a mass of soft laterite that is hardened in exposed places. I suspect that during the next few days I shall see many real Ground-Water Laterites.

Director Jurion and I have supper again with the Soyers.

This "rest" day has been a little hard on my nerves from the constant chatter of very rapid French, usually with several people talking at once.

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/a Alternate spelling of the name.

June 23: South of Elisabethville

First in the morning we see the Governor for a few minutes and then go out to look at the soils south of the city. We stop about 7 kilometers south of Elisabethville. I look at a yellow Ground-Water Laterite on nearly flat, or very gently undulating, upland. The soil is imperfectly drained but, compared to others in this region, is fairly well drained. The vegetation is savanna with thin savanna shrubs and low savanna trees.

Soil Profile Sample No. 33

I/a

A_1	0 - 1"	Medium-gray fine sandy loam; very porous, brittle, and easily friable. Now extremely dry. Light brownish-gray when dry.
A_2	1 - 8 (5-15")	Yellowish-gray fine sandy loam; irregular poorly developed nut structure; easily friable; many large pores and small holes. Pale brown when dry.
A_3	8 - 12"	Transitional. Grayish-yellow gravelly fine sandy loam; friable with some difficulty; many small roots. Very pale brown to yellow when dry.
B_{10}	12 - 23"	Yellow gravelly fine sandy clay loam mottled a little with orange-red; quite hard; a few roots.

/a Roman numerals refer to numbers on the sketch showing relationship among profiles south of Elisabethville.

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B_{11}	23 - 45"	Mottled yellow (major) and red (minor) somewhat cemented, hard concretionary mixture; extremely dry; a few small roots in upper part. Grades into:
B_2 or B_3	45 - 70" plus	Mottled red (major) and yellow (minor) sandy clay; soft when moist but hardens irreversibly upon exposure.

In nearby ditches the B horizon has completely hardened so that the soils of the ditches resemble masonry. The whole soil above the B_2 is now powdery dry and the vegetation is nearly dormant. In rainy seasons the water table stands at about 12 inches from the surface; now it is several feet beneath the surface. There are some fairly large termite mounds. The underlying rock is said to be quartzitic schist. This is very deep. There are a few small quartz crystals in the profile.

I go a little farther south down a long very gentle slope. I see a deep pit where the weathered schist is only about 3 feet from the surface. It is a deep red, streaked with yellow. I take a special sample of it. Weathering has progressed very far and this material is close to laterite although the rock layers persist.

I look at another profile on Ground-Water Laterite about 8 kilometers south of Elisabethville in a nearly level high plain used for pasture.

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Table 21. Analyses of Ground-Water Laterite. (33)

Sample No.	Horizon	Depth	pH	Organic ~~Matter~~ Carbon	Size Class and Diameter of Particles (*in mm.*)							Other Classes (*in mm.*)		
					Very course sand 2–1	Coarse sand, 1–0.5	Medium sand, 0.5–0.25	Fine sand, 0.25–0.1	Very fine sand, 0.1–0.05	Silt, 0.05–0.002	Clay, <0.002	0.02–0.002	<0.005	>2
		Inches		*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
48798	A_1	0-1	5.6	3.3	1.5	2.5	2.7	8.7	24.6	39.1	20.9	15.2	25.1	0
799	A_2	1-8	4.8	1.6	1.6	2.9	2.9	9.2	25.0	34.1	24.3	10.7	26.8	0
800	B_1	8-12	5.1	0.9	1.9	1.9	1.7	6.1	22.6	29.7	36.1	10.3	38.1	0
801	B_{20}	12-23	5.4	0.5	2.4	1.6	1.0	4.4	22.2	32.4	36.0	12.0	38.6	0
802	B_{21}	23-45	5.5	0.2	11.5	11.7	4.0	7.3	14.3	27.7	23.5	11.6	26.7	0
803	B_3 or C_1	45-70+	5.4	0.1	6.7	8.1	3.4	7.7	18.1	30.1	25.9	13.1	29.6	0
804	C_2	---	5.0	<0.1	1.1	3.3	1.7	2.2	2.5	63.7	25.5	57.0	43.1	0

Sample No.	Horizon	Depth	Exchangeable Cations me/100 g					Sum of Cations me/100 g	% Base Saturation
			Ca	Mg	Mn	K	H		
48798	A_1	0-1	3.0	1.0	0.15	0.3	9.4	13.8	32
799	A_2	1-8	0.2	0.4	0.10	0.1	9.8	10.6	8
800	B_1	8-12	0.7	0.8	0.01	0.1	7.4	9.0	18
801	B_{20}	12-23	0.8	0.9	0.01	0.1	5.6	7.4	24
802	B_{21}	23-45	0.7	0.8	0.01	0.1	5.0	6.6	24
803	B_3 or C_1	45-70+	0.8	0.9	0.03	0.1	5.2	7.0	26
804	C_2	---	0.2	0.2	<0.01	0.2	6.6	7.2	8

Sample No.	Horizon	Depth	Total P (%)	Available P (p.p.m.)
48798	A_1	0-1	.040	20
799	A_2	1-8	.025	6
800	B_1	8-12	.024	—
801	B_{20}	12-23	.004	3
803	B_3 or C_1	45-70+	.024	4

Thermal Analysis Data

Particle Size Analyzed	Minerals Present: Kaolinite ~~Type~~ %	Hydrous oxides* %
<2μ	40	15
<2μ	45	10
<2μ	45	

*Presumably Gibbsite

Congo Soil Profile No. 33

U. S. GOVERNMENT PRINTING OFFICE 16—46512-2

Core Soil Profile No. 83

Sample No.	Horizon	Depth (cm)	pH	Organic Carbon %	Size Class and Particle Diameter of Primary Particles (in mm.)							Other Classes (in mm.)		
					Very coarse sand 2-1	Coarse sand 1-0.5	Medium sand 0.5-0.25	Fine sand 0.25-0.1	Very fine sand 0.1-0.05	Silt 0.05-0.002	Clay <0.002	0.02-0.002	<0.005	>2
					Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
4736	A	0-1	5.6	2.2	1.5	3.2	3.7	8.7	24.6	49.1	20.9	15.3	15.3	0
728		1-8	4.8	1.8	1.8	3.8	1.8	5.8	25.0	49.8	10.7	10.3	25.8	0
800	B	8-15	5.1	0.9	1.8	3.8	1.8	4.8	25.0	48.8	13.8	13.1	28.1	0
801		15-25	5.4	0.5	4.2	11.2	4.0	4.2	22.2	37.4	12.4	0.2	38.8	0
802		25-45	5.2	0.0	2.2	6.1	2.2	4.1	22.2	38.1	15.1	11.1	30.1	0
803		45+70	5.0	0.0	1.0	2.2	1.7	3.5	18.1	38.3	18.3	8.3	42.1	0
804	C	70+	---	---	---	---	---	---	---	---	---	---	---	---

Exchangeable Cations me/100 g

Sum of Cations me/100 g	Base Saturation %	Total P (%)	Available P (p.p.m.)	Mineral Analysis Data		Thermal Analysis Data
				Particle size	Mineral Present	
				V sand	Hydrous oxides of Iron-Aluminum	Estimated Percentage
Ca	Mg	K	Na			
me/100 g						
3.4	0.3	0.15	0.1			
8.8	0.6	0.10	0.1			
7.4	0.3	0.08	0.1			
5.5	0.3	0.05	0.1			
6.6	0.3	0.02	0.1			
7.2	0.3	0.02	0.1			
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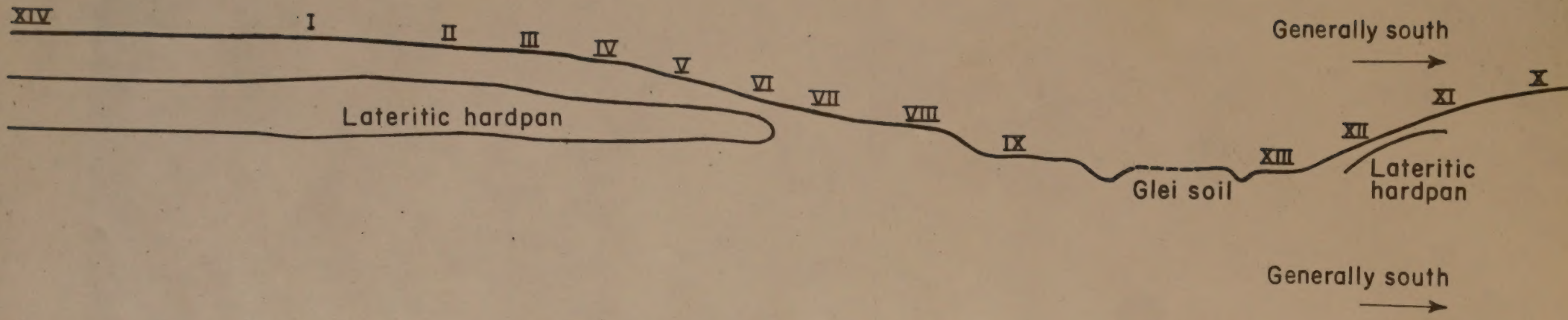
U. S. GOVERNMENT PRINTING OFFICE 16—31809-2



Rough schematic sketch showing relationship among soil profiles south of Elisabethville

I. Yellow Ground-Water Laterite on upland
II. Yellow Ground-Water Laterite on upland
III. Yellow Ground-Water Laterite on upland
IV. Yellow Ground-Water Laterite on upland
V. Shallow, Yellow Ground-Water Laterite on upland
VI. Yellowish-red Ground-Water Laterite on upland
VII. Red Lateritic on terrace
VIII. Red Lateritic on terrace
IX. Half-Bog on marly clay
X. Red Lateritic on upland (or terrace?)
XI. Red Lateritic on terrace
XII. Yellow Ground-Water Laterite on terrace
XIII. Gray hydromorphic
XIV. Yellow (or Gray) Ground-Water Laterite in upland flat

K-1421 June 23, 1947
Belgian Congo. About 8 kilometers south of Elisabethville. Landscape on yellow Ground-Water Laterite. A poor soil, used for cattle pasture in rainy season. Very dry now.

K-1427-1

14-12

K-1427 June 23, 1947
Belgian Congo. About 8 kilometers south of
Elisabethville. Landscape on yellow Ground-
Water Laterite. A poor soil, used for cattle
pasture in rainy season. Very dry now.

K-1422 June 23, 1947
Belgian Congo. About 10 kilometers south of Elisabethville. Profile of yellow soil over red Ground-Water Laterite.

K-1122 June 23, 1947
Belgian Congo. About 10 kilometers south of Elisabethville. Profile of yellow soil over red Ground-Water Laterite.

II

A_1	0 - ½"	Dark gray gravelly fine sandy clay loam; hard; contains many re-hardened fragments of weathered schist.
A_2	½ - 8"	Yellowish-gray gravelly fine sandy clay; hard in place.
A_3	8 - 15"	Yellowish-gray gravelly fine sandy clay loam.
B_1	15 - 22"	Reddish-yellow, mottled with dark red, compact gravelly clay loam.
B_2	22 - 37"	Orange-red gravelly clay with many small fragments of dark red partially weathered schist.
B_3	37 - 50"	Highly mottled dark red and yellow putty-like weathered schist.
C	50 - 80" plus	Highly mottled and streaked dark red and gray, with a little yellow, putty-like weathered schist. (I take a special undisturbed sample of this material with a metal box.)

The upper soil has many small flattened rehardened fragments of weathered schist. Thus the lateritic concretions inherit shape from the mother rock even with complete chemical alteration. The water table is very near the surface in the rainy season. Now it is deep and the soil is very dry. This is a poor soil, but has some use for pasture in the rainy season.

II

A_1	0 - $\frac{1}{2}$"	Dark gray gravelly fine sandy clay loam; hard; contains many re-hardened fragments of weathered schist.
A_2	$\frac{1}{2}$ - 8"	Yellowish-gray gravelly fine sandy clay; hard in place.
A_3	8 - 15"	Yellowish-gray gravelly fine sandy clay loam.
B_1	15 - 22"	Reddish-yellow, mottled with dark red, compact gravelly clay loam.
B_2	22 - 37"	Orange-red gravelly clay with many small fragments of dark red partially weathered schist.
B_3	37 - 50"	Highly mottled dark red and yellow putty-like weathered schist.
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A few hundred feet away where there is a trifle more slope, the soil has more red color in the solum but the C is about the same.

III

A_1	0 - 3/4"	Medium-gray fine gravelly (concretionary) fine sandy clay loam.
A_2	3/4 - 10"	Grayish-yellow fine gravelly (concretionary) fine sandy clay loam; somewhat hard.
A_3	10 - 16"	Grayish-yellow gravelly fine sandy clay loam; quite hard in place; many rounded concretions that are largely re-hardened weathered schist fragments.
B_1	16 - 29"	Semi-hardened lateritic hardpan. Rather finely-mottled dark red, yellow, and orange-red.
B_2 (or C_C)	29 - 57"	Lateritic hardpan. Now, when moist, it is semi-hard but the material becomes rock-like when exposed.
C	57 - 90" plus	Like the C in the previous profile.

The water table in rainy seasons stands at about 10 to 15 inches below the surface. Now it is quite deep. I am surprised to see some fine roots as deep as 5 feet. There are a great many small concretions on the surface. More than one-half of these inherit a flattened shape from the mother rock.

A few hundred feet away where there is a trifle more slope, the soil has more red color in the solum but the C is about the same.

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A_3	10 - 16"	Grayish-yellow gravelly fine sandy clay loam; quite hard in place; many rounded concretions that are largely re-hardened weathered schist fragments.
B_1	16 - 29"	Semi-hardened lateritic hard-pan. Rather finely-mottled dark red, yellow, and orange-red.
B_2 (or C_0)	29 - 57"	Lateritic hardpan. Now, when moist, it is semi-hard but the material becomes rock-like when exposed.
C	57 - 90" plus	Like the C in the previous profile.

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Crops can be grown here only on the termite mounds, although some pasture can be had in the rainy season. Termite mounds are not very numerous. They are about 6 to 100 feet high and around 25 feet in diameter. They are composed of brownish-gray cloddy clay, now very hard.

Not far away I look at another profile part way down a long slope of about 1 to 2 percent. The cover is poor pasture although originally it was grass, shrubs, and a few low trees.

Soil Profile Sample No. 34

IV

A_1	0 - 3/4"	Medium-gray gravelly (concretionary) fine sandy loam; porous, brittle, and friable; very dry.
A_2	3/4 - 5" (0-10")	Yellowish gravelly fine sandy clay loam; firm, brittle, and friable; many roots; very dry. Pale yellow when dry.
B_2	5 - 35"	Hard lateritic hardpan. Dark red mottled with orange-red and yellowish-gray. Grades into:
B_3	35 - 60"	Soft concretionary clay; mottled yellow, red, brown, grayish-yellow, and orange-red.
C	60 - 80" plus	Highly mottled red and yellow soft fine sandy clay from schist. Mainly reddish-yellow when dry.

The soil is very dry and dusty when dug out now. The surface soil over the lateritic hardpan seems to be leached and to have had some clay removed (Podzolization?). Usually there is a transition between A_2 and the hardpan. In this area there are a few outcrops of the hardened B_2.

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About 10 kilometers south of Elisabethville, I look at a profile much like the first one examined this morning. This one is on a terrace just below the long slope on which sample No. 34 is near the lower part.

V

A_1	0 - 1"(probably)	Has been disturbed.
A_2	1 - 15"	Grayish-yellow gravelly (concretionary) fine sandy clay. Hard in place but digs out easily as a mass of concretions and dust.
B_2	15 - 40"	Fairly hard lateritic hardpan; mottled dark red, orange-red, and yellow.
B_3	40 - 68"	Semi-hard lateritic hardpan of red clay and coarse gravel from quartzitic schist.
C	68 - 80" plus	Coarsely mottled dark purplish-red and yellow clay from schist. This rock is in the upper part of an old rock terrace. The water table is high in the rainy season and now is about 30 feet deep.

This is starting out to be a bad day. At the first profile my light meter failed, and at this last one, one of my willing assistants broke my ruler!

I go back to Elisabethville for lunch and am able to get a new light meter for 1,750 francs. This certainly is a piece of luck!

About 10 kilometers south of Miasebetnville, I took a profile much like the first one examined this morning. This one is on a terrace just below the long slope on which sample No. 24 is near the lower part.

A_1	0 - 1" (probably)	Has been disturbed.
A_2	1 - 15"	Grayish-yellow gravelly (concretionary) fine sandy clay. Hard in place but digs out easily as a mass of concretions and dust.
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K-1526 June 23, 1947
Belgian Congo. Elisabethville. Profile of Ground-Water Laterite.

K-1526 June 23, 1947
Belgian Congo. Elisabethville. Profile
of Ground-Water Lateritе.

The area under examination is included in an experimental farm (not experimental station) that is just now being taken over by INEAC. After lunch we continue the investigation. I look at a profile on an old stream terrace only a few hundred feet from the last. The land is in pasture. The terrace has a gentle slope of perhaps 2 percent.

VI

A_1	0 - 1" (probably)	Has been disturbed.
A_2	1 - 17"	Yellow gravelly fine sandy loam with many small rounded concretions. The soil is firm to hard in place but digs out in hard small angular nut. Very dry.
A_3	17 - 26"	Like the above but a little harder and somewhat darker red.
B_1	26 - 44"	Semi-hard lateritic pan mottled with yellow, red, orange-red, and nearly black. High in clay content. Many dark red to black concretionary pebbles. Grades into:
B_2	44 - 60"	Semi-indurated like the above, but with larger concretions and some weathered quartzitic cobbles. The heavy clay between the coarse particles is red; the fine sandy clay is yellow. There are many nearly black concretionary pebbles. Now moist.
C	60 - 90" plus	Semi-indurated, but a little softer than the above, mass of weathered schist fragments and coarse alluvium. Mottled red, yellow, gray, orange-red, and reddish brown. Some concretionary pebbles. Many pieces of partially weathered quartz that are easily broken. Now moist.

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Some small roots extend to the C. Here in the rainy season the water table is deeper than in the soils previously described. It is said to be below 5 or 6 feet, but I suspect that it is often higher.

I look at another profile 300 or 400 feet farther down the slope and on the terrace. Here there is fair pasture although the soil in the field is very hard. I note a remarkable change in the soil for so short a distance with no indicating surface feature at all.

VII

A_p	0 - 5"	Reddish-brown fine sandy clay; digs out in hard medium nut. Porous; many fine roots.
A_3	5 - 15"	Slightly yellowish, red fine sandy clay; digs out in hard, irregular, angular blocky pieces. No concretions. Quite a few roots.
B_2	15 - 40"	Pale red or dark pinkish-red fine sandy clay; digs out in hard irregular angular nut, difficult to crush.
B_3	40 - 60"	Pinkish-red friable fine sandy clay with a very few small concretions.
C	60 - 85" plus	Like the above but moist, soft, and slightly mottled with yellow and orange-red.

The soil is very dry above 40 inches, but moist below that. The water table stands now at 9 feet because there is an irrigation ditch lower down on the slope but only 50 feet away. I

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wonder why there is no lateritic hardpan here! I suspect that it may be, in part, because of some mixing of limestone material in the general alluvium deposited on the terrace.

I continue on down this long gentle slope to an irrigated pasture about 150 feet away. Another 100 feet beyond, the slope breaks sharply (about 8 percent) to a wet alluvial bottom. The slope here is about 3 percent. There are many more termite mounds.

VIII

A_{1-P}	0 - 1½" (1-3")	Brownish-gray fine sandy clay; hard in place and digs out in hard clods.
A_2	1½ - 7"	Brown clay with faint reddish- and orange-red mottlings; digs out in large roughly prismatic blocks.
B_1	7 - 23" (20-30")	Orange-red fine sandy clay; hard like the above.
B_2	23 - 35"	Darker orange-red clay; digs out in clods that can be crushed to relatively hard, but friable irregular subangular nut. Quite a few holes and old root stains.
B_3	35 - 45" plus	Dark orange-red friable fine sandy clay, now moist and relatively mellow.

Roots penetrate to at least 45 inches. The soil has cracks that extend from the surface to the B_3. This soil supports a fairly good irrigated pasture developed by seeding.

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A_{1-p}	0 - 1½" (1-3")	Brownish-gray fine sandy clay; hard in place and dips out in hard clods.
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I continue on down this long gentle slope to an irrigated pasture about 150 feet away. Another 100 feet beyond, the slope breaks abruptly (about 8 percent) to a wet alluvial bottom. The slope here is about 3 percent. There are many more termite mounds.

K-1423 June 23, 1947
Belgian Congo. South of Elisabethville about 12 kilometers on experimental farm. Irrigated pasture on brown over orange-red lateritic soil on stream terrace. The numerous large old termite mounds indicate relatively good soil for this region of poor soils. (Profile No. VIII)

K-1423 June 23, 1917
Belgian Congo. South of Elisabethville
about 12 kilometers on experimental farm.
Irrigated pasture on brown over orange-red
lateritic soil on stream terrace. The
numerous large old termite mounds indicate
relatively good soil for this region of
poor soils. (Profile No. VIII)

I continue down the slope and look at the soil near the margin of a wet alluvial basin:

IX

A_1	0 - 12"	Very dark brown to black sticky plastic clay.
G_1	12 - 20"	Dark gray clay gradually changing to:
G_2 or C	20" plus	White calcareous clay.

Out in the flat a similar soil has been seeded to alfalfa that is irrigated. It is too early in the life of the crop to tell whether it will do well or not. Maize did well here. This was cut for silage in May at the end of the rainy season. On the farm they are now beginning to feed it to dairy cows.

On the opposite side of this wet land, farther south, INÉAC is just building an experimental station. The series of profiles just described are all on the experimental farm except for the first one. I now go over to the other side of the alluvial bottom to look at some of the soils where the experimental station is being established.

The first one I look at is on an upland terrace. The profile pit is not very well located. It was made in an open area planned for a park and the land has been leveled a bit. Over the solum is a 6-inch overburden of orange-red clay.

I continue down the slope and look at the soil near the margin of a wet alluvial basin:

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X

A_1	0 - 3"	Slightly reddish, brown fine sandy clay; irregularly granular; many roots.
A_3	3 - 6"	Reddish-brown fine sandy clay with irregular nut structure; aggregates hard; many roots.
B_1	6 - 15"	Slightly yellowish, red clay; hard; digs out in irregular nut but can be crushed with great pressure. Although hard and dry, the soil is much less so than the lateritic hardpan seen this morning.
B_2	15 - 32"	Red, with orange tinge, fine sandy clay; hard, but digs out in pieces that are friable under pressure.
B_3	32 - 55" plus	Bright orange-red to red, moist, mellow fine sandy clay; somewhat firm in place, but digs out easily.

Roots go to 55 inches and perhaps more. A few vertical cracks extend from the surface to the top of the B_3. There are no concretions. The slope here is about $2\frac{1}{2}$ percent.

A few hundred feet down the slope I examine another profile. Originally this area had thin forest with savanna. From the lay of the land I gather that there might have been some limestone material incorporated into the parent material.

X continue down the slope and look at the soil near

A_1	0 - 3"	Slightly reddish, brown fine sandy clay; irregularly granular; many roots.
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XI

A_1	0 - 1"	Reddish-brown fine sandy clay loam or clay; porous, brittle, and hard; digs out in small irregular clods and dust.
A_2	1 - 6"	Orange-red fine sandy clay; digs out in rather hard nut-sized pieces.
B_1	6 - 21"	Slightly orange, red fine sandy clay; digs out in irregular subangular medium nut that can be crushed with hard pressure.
B_2	21 - 39"	Red to orange-red fine sandy clay; friable subangular nut with many semi-indurated dark red concretions.
B_3	39 - 60"	Orange-red sandy clay with many semi-indurated concretions; mottled with yellow and very dark reddish-brown; digs out easily as a mass of granular angular nut and concretions.
C	60 - 65" plus	Mottled yellow, gray, and orange-red sandy clay with many brown and dark brown semi-indurated concretions; digs out easily.

The roots grow to the top of the C. The upper 40 inches has many small holes.

I go down a few hundred feet farther on this gentle slope. The soil here is a Ground-Water Laterite with no indication whatever of any change in the surface configuration. (What a job it would be to make a detailed map of these soils!)

XI

A_1	0 - 1"	Reddish-brown fine sandy clay loam or clay; porous, brittle, and hard; digs out in small irregular clods and dust.
A_2	1 - 6"	Orange-red fine sandy clay; digs out in rather hard nut-sized pieces.
B_1	6 - 21"	Slightly orange, red fine sandy clay; digs out in irregular sub-angular medium nut that can be crushed with hard pressure.
B_2	21 - 39"	Red to orange-red fine sandy clay; friable subangular nut with many semi-indurated dark red concretions.
B_3	39 - 60"	Orange-red sandy clay with many semi-indurated concretions; mottled with yellow and very dark reddish-brown; digs out easily as a mass of granular angular nut and concretions.
C	60 - 65" plus	Mottled yellow, gray, and orange-red sandy clay with many brown and dark brown semi-indurated concretions; digs out easily.

The roots grow to the top of the C. The upper 40 inches has many small holes.

I go down a few hundred feet farther on this gentle slope. The soil here is a Ground-Water Laterite with no indication whatever of any change in the surface configuration.

(What a job it would be to make a detailed map of these soils!)

XII

A_P	0 - 6"	Dark grayish-brown fine sandy clay loam; very dry; digs out in large blocky pieces that are friable with hard pressure.
A_3	6 - 15" (14-20")	Yellowish-brown, mottled with yellow, orange-red, and reddish-brown, mixture of concretions and fine sandy clay; firm in place but can be dug out easily.
B_1	15 - 28"	More finely mottled lateritic hardpan.
B_2	28 - 60"	Mottled pinkish-red, gray, yellow, and orange-red hard lateritic hardpan. In the lower part there are some large cobbles of schist imbedded in the hardpan.

It is said that the possibility exists that limestone might be far underneath. If so, I doubt that it has had any significant influence on the solum. The water table now stands at 6 feet.

I now go down the slope and into the lowland.

XIII

A_1	0 - 12"	Dark gray sandy clay; hard when dry and plastic when wet.
G_1	12 - 28"	Transitional. Medium-gray, mottled with gray and yellow, plastic clay grading into:
G_2 or C	28" plus	Light gray plastic clay.

The water table is at 20 inches below the surface.

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A_p	0 - 6"	Dark grayish-brown fine sandy clay loam; very dry; digs out in large blocky pieces that are friable with hard pressure.
A_3	6 - 15"	(14-20") Yellowish-brown, mottled with yellow, orange-red, and reddish-brown, mixture of concretions and fine sandy clay; firm in place but can be dug out easily.
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The water table is at 20 inches below the surface.

In another place I notice that the lower glei is clayey gravelly sand that hardens about like cement concrete upon exposure.

This is an area of poor soils. So far as I have seen today, the underlying rocks are schist. According to the geological maps, limestone and conglomerate are exposed in narrow bands in some parts of the area. Generally, the area is a gentle plain with only mild soft dissection. Between streams some areas are dead flats while others are gently undulating. Soils on the gently undulating places are much better, but all are poor.

This was a real workout today with many people standing about chattering in French and me trying to get my work done. It was very fortunate that most of the pits had been prepared very deeply indeed -- some over 25 feet.

I am pleased with this day's work. Several of these soils I regard as characteristic Ground-Water Laterite, right out of the book. Unless the surface soil of these is relatively thin, the lower material does not harden to stone. It only does so where the soils are partly truncated or the lower material is exposed as in a ditch bank or road cut.

These soils are so poor that they present an extremely difficult agricultural problem. There is need for food crops, especially vegetables and dairy products, but even pasture is

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June 24: Near Elisabethville

First in the morning I go out northwest of the city and look at some deep excavations in a smooth area of yellow Ground-Water Laterite having a slope of around 1 percent. Recently it was cleared and planted to fruit trees, most of which have died. In the area are several wells about 40 feet deep with water at 24 feet. About 35 feet beneath the surface is a grayish-blue calcareous (?) schist. At first I have no ladder and can only look at the upper part of the soil.

A_P	0 - 5"	Grayish-yellow heavy fine sandy loam. This is hard in place and digs out in large porous clods that are quite easily friable to dust.
A_2	5 - 15"	Bright yellow fine sandy loam; firm in place, but easily friable.
A_3	15 - 30"	Yellow gravelly fine sandy loam with orange-red and dark red concretions.
B_1	30 - 40"	Transitional.
B_2	40 - (?)	Mottled dark red and yellow lateritic hardpan from schist.

I examine another well where the water table is 18 feet beneath the surface and the soil has a somewhat shallower solum.

June 24: Near Elizabethville

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A_p	0 - 5"	Greyish-yellow heavy fine sandy loam. This is hard in place and digs out in large porous clods that are quite easily friable to dust.
A_2	5 - 15"	Bright yellow fine sandy loam; firm in place, but easily friable.
A_3	15 - 30"	Yellow gravelly fine sandy loam with orange-red and dark red concretions.
B_1	30 - 40"	Transitional.
B_2	40 - (?)	Mottled dark red and yellow lateritic hardpan from schist.

I examine another well where the water table is 18 feet beneath the surface and the soil has a somewhat shallower solum.

K-1424 June 24, 1947
Belgian Congo. Near northwest Elisabethville. View of site on which fruit trees were planted (most now dead). Site of soil profile sample No. 35 -- a yellow Ground-Water Laterite.

K-1424 June 24, 1947
Belgian Congo. Near northwest Elisabethville.
View of site on which fruit trees were planted
(most now dead). Site of soil profile sample
No. 35 -- a yellow Ground-Water Laterite.

I examine another pit in this area on a short gentle slope of about 1½ to 2 percent.

Soil Profile Sample No. 35

A_P	0 - 1"	Yellowish-gray fine sandy loam; hard, porous, brittle, and friable. (Disturbed and not sampled.)
A_2	1 - 6"	Grayish-yellow very fine sandy loam; digs out in chunks which break into hard irregular nut. Very pale brown to yellow when dry.
A_3	6 - 14"	Reddish-yellow or orange-yellow fine sandy clay mottled with red; many concretions. Reddish-yellow to yellow when dry.
B_2	14 - 33"	Mottled red and reddish-yellow mixture of concretions and clay; semi-indurated. (Special undisturbed sample taken in brass tube.)
B_3	33 - 55"	More broadly mottled soft dark red and orange-red fine sandy clay. One sees obvious relicts of old rock structure. (Not sampled) Gradually changes to:
C	55 - 70" plus	Putty-like fine sandy clay or rotten schist; reticulate mottling of dark red and yellow with a little gray. (Special undisturbed sample taken in brass tube.)
D		Red weathered schist at about 15 to 20 feet. Blue schist at about 35 feet.

We continue to drive out northwest of Elisabethville. I see more soil like the one just described except that it is not

I examine another pit in this area on a short gentle slope of about 1½ to 2 percent.

Soil Profile Sample No. 35

A_p	0 - 1"	Yellowish-gray fine sandy loam; hard, porous, brittle, and friable. (Disturbed and not sampled.)
A_2	1 - 6"	Grayish-yellow very fine sandy loam; digs out in chunks which break into hard irregular nut. Very pale brown to yellow when dry.
A_3	6 - 14"	Reddish-yellow or orange-yellow fine sandy clay mottled with red; many concretions. Reddish-yellow to yellow when dry.
B_2	14 - 33"	Mottled red and reddish-yellow mixture of concretions and clay; semi-indurated. (Special undisturbed sample taken in brass tube.)
B_3	33 - 55"	More broadly mottled soft dark red and orange-red fine sandy clay. One sees obvious relicts of old rock structure. (Not sampled) Gradually changes to:
C	55 - 70" plus	Putty-like fine sandy clay or rotten schist; reticulate mottling of dark red and yellow with a little gray. (Special undisturbed sample taken in brass tube.)
D		Red weathered schist at about 15 to 20 feet. Blue schist at about 35 feet.

We continue to drive out northwest of Elisabethville. I see more soil like the one just described except that it is not

Sample No.	Horizon	Depth	pH	Organic ~~Matter~~ Carbon	Size Class and Diameter of Particles (*in mm.*)							Other Classes (*in mm.*)		
					Very course sand 2–1	Coarse sand, 1–0.5	Medium sand, 0.5–0.25	Fine sand, 0.25–0.1	Very fine sand, 0.1–0.05	Silt, 0.05–0.002	Clay, <0.002	0.02–0.002	<0.005	>2
		Inches		*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
48810	A_2	1-6	5.0	0.8	2.2	1.1	0.7	3.7	12.6	51.1	28.6	28.1	35.2	5
811	A_3	6-14	5.3	0.4	3.0	1.3	0.6	2.8	8.5	45.7	38.1	23.8	44.0	32
814	D_1	15-20 ft.	5.3	<0.1	Not determined --			---	---	---	---	---	---	---

			Exchangeable Cations me/100 g					Sum of Cations me/100 g	% Base Saturation
			Ca	Mg	Mn	K	H		
48810	A_2	1-6	0.4	0.6	0.14	0.5	7.1	8.7	19
811	A_3	6-14	0.1	1.2	0.09	0.6	6.2	8.2	24

Congo Soil Profile No. 35

U. S. GOVERNMENT PRINTING OFFICE 16—46512-2

Congo Soil Profile No. 55

Sample No.	Horizon	Depth	pH	Organic Carbon	Size Class and Particle Diameters (in mm.)								
					Very coarse sand, 2–1	Coarse sand, 1–0.5	Medium sand, 0.5–0.25	Fine sand, 0.25–0.1	Very fine sand, 0.1–0.05	Silt, 0.05–0.005	Clay, <0.005	Organic Matter	>2
48810	A1	1–8	5.0	0.6	8.2	7.2	0.7	2.7	75.6	5.1	8.6	1.8	---
	B21	8–30	5.3	0.4	0.0	1.2	0.6	2.8	8.2	45.7	38.1	0.4	---
	B22	30–54	5.3	<0.1	0.0	0.5	0.0	0.7	2.8	52.8	38.8	0.4	---
48811	A1	1–8	5.0	0.6	8.2	7.1	0.7	2.7	75.6	5.1	8.6	1.8	---
	A3	8–14	5.3	0.4	0.0	0.6	0.0	2.8	8.2	45.7	38.1	0.4	---
	B1	14–30	5.3	<0.1	0.0	0.5	0.0	0.7	2.8	52.8	38.8	0.4	---
48810	A1	1–8	5.0	0.6	8.2	7.1	0.7	2.7	75.6	5.1	8.6	1.8	---
	A3	8–14	5.3	0.4	0.0	1.2	0.6	2.8	8.2	45.7	38.1	0.4	---
	B1	14–30	5.3	<0.1	0.0	0.5	0.0	0.7	2.8	52.8	38.8	0.4	---

Size Class and Diameters of Particles (in mm.)

Other Classes (in mm.)

Exchangeable Cations M.E./100 Gm. Soil

Ca	Mg	K
0.4	0.2	0.14
1.2	0.5	0.03

Sum of Cations Base Saturation %

M.E./100 Gm. Soil

8.7	79
8.2	24

Not determined

U.S. GOVERNMENT PRINTING OFFICE 16—52013-3

quite so hard and had more forest in the original vegetation. Here there are more large termite mounds. These mounds are near the edge of the Kipopo Creek and the material may be an ancient terrace. The clay in these mounds is good for making bricks and also supports better vegetation than the surrounding soils.

I look at the soil on a very gently undulating part of the plain. Here there is a good stand of trees, that is, good for this region, although thin, with a grassy ground cover.

A_1	0 - 1½"	Gray fine sandy loam; brittle and easily friable to dust.
A_{20}	1½ - 6"	Grayish-yellow heavy fine sandy loam; quite hard in place and digs out in irregular blocky; friable only under hard pressure.
A_{21}	6 - 15"	Yellow fine sandy loam; digs out fairly easily in hard irregular nut.
A_3	15 - 21"	Mixture of yellow fine sandy clay loam and dark red semi-indurated concretions; firm in place but digs out fairly easily.
B_2	21 - 56"	Mixture of mottled dark yellow to orange-red and red fine sandy clay and semi-indurated red clay. There are some layers of quartz gravels; firm to almost semi-indurated. Grades into:
B_3	56 - 65" plus	Firm but fairly soft; coarsely mottled dark yellow and red fine sandy clay.

A part of the area of this soil has a stand of natural forest that has been protected from fire. The principal trees

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are Marquefia (and) Nonotas (?), sipterocarfaces, Pterocarpus, Brachystegia (dominant), Parinari, and Uapaca. On the termite mounds there are some bamboos and a few Euphorbia.

I walk through this woods for a distance of a kilometer or so to see a wet "dembo". The owner of this wet grassland area has put in the proper ditches and plans to build a series of artificial fish ponds.

I look at the soil near the margin:

A_1	0 - 12"	Dark brownish gray moist plastic fine sandy clay; sticky; many roots. Some yellowish-brown mottling.
G_1	12 - 40"	Light gray plastic sticky fine sandy clay mottled with dark yellow and orange-red. Grades into:
C_C	40" plus	Gravelly lateritic pan which hardens upon exposure. Gray, mottled with dark yellow in place. The rounded gravels (probably old concretions) are brown on the inside.

The water table stands at 23 inches. There are a few small termite mounds 1 to 3 feet high.

The principal grass is Hyparrhenia.

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K-1425 June 24, 1947
Belgian Congo. A few kilometers northwest of of Elisabethville. View on wet "dembo" with Half-Bog soil over lateritic alluvial material. Main grass is hyparrhenia.

K-1527 June 24, 1947
Belgian Congo. North Elisabethville. Road cut through termite mound.

15-4

K-1525 June 24, 1947
Belgian Congo. A few kilometers northwest of
of Elisabethville. View on wet "dembo" with
Salt-Bog soil over lateritic alluvial material.
Main grass is hyparrhenia.

K-1527 June 24, 1947
Belgian Congo. North Elisabethville. Road cut
through termite mound.

K-1426 June 24, 1947
Belgian Congo. A few kilometers northwest of Elisabethville. Natural vegetation of thin forest on undulating strongly lateritic soil transitional to (but not itself) Ground-Water Laterite. Main trees Brachystegia, Pterocarpus, Parinari, Uapaca, and Dipterocarfaces.

K-1820 June 24, 1947
Belgian Congo. A few kilometers northwest of Elisabethville. Natural vegetation of thin forest on undulating strongly lateritic soil transitional to (but not itself) Ground-Water Laterite. Main trees Brachystegia, Pterocarpus, Parinari, Uapaca, and Diplorrhynchus.

Out in the area a few hundred feet farther, the water stands at the very surface.

A_{10}	0 - 2"	Nearly black mixture of tough grass roots and sticky silty clay.
A_{11}	2 - 12"	Very dark gray to nearly black silty clay; many roots.
G_1	12 - 24" (?)	Medium to light gray plastic sticky silty clay mottled with light brown; many roots.
C	24" plus	The soil grades into lighter gray silty clay with increasing amounts of rounded lateritic concretions. At about 30 inches and deeper are some quartz pebbles and small cobbles. When dry the material becomes hard.

Out near the center the soil is very wet indeed. These wet dembos are sometimes used for pasture. A few have been drained and used for vegetables by European farmers. It is interesting that this wet area is the source of two streams flowing in different directions.

It is already late in the morning and I must get back to Elisabethville for luncheon with Soyer.

On the way back just north of west from Elisabethville, I look hurriedly at a deep red soil on an old terrace with material largely of limestone origin. There is no opportunity for making a deep profile, but I take samples of the surface horizons.

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Soil Profile Sample No. 36

A_p	0 - 14"	Brownish, deep red, granular clay. There are many termite holes with soft sponge-like concretions made by the termites. Red to dark red when dry.
B_2	14 - 34"	Deep red clay, softly granular; slightly firm in place.
B_3	34 - 40" plus	Like the above with a little brighter red color.

I also take a special sample of the nearly white sponge-like calcareous(?)/material from the lower A_p. On this material the termites grow fungi for food. This activity of the termites is said to be quite characteristic of soils from calcareous or dolomitic materials in this region. It is said that the soil here is about 3 meters above the rock, but there are no cuts in the vicinity.

This appears to me to be an excellent soil. But there is only a little of it here and this in narrow bands. At this place vegetables are being grown successfully under irrigation.

But most of the soil around Elisabethville is nearly flat Ground-Water Laterite of various types, like the first two described this morning and the first five described yesterday. The cover is mostly grass, weeds, scattered shrubs, and low trees. The landscape resembles a little the scrub oak second growth on American Planosols, like the Lufkin, for example.

Soil Profile Sample No. 35

A_p	0 - 14"	Brownish, deep red, granular clay. There are many termite holes with soft sponge-like concretions made by the termites. Red to dark red when dry.
B_2	14 - 34"	Deep red clay, softly granular; slightly firm in place.
B_3	34 - 40" plus	Like the above with a little brighter red color.

I also take a special sample of the nearly white sponge-like calcareous material from the lower A_p(?). On this material the termites grow fungi for food. This activity of the termites is said to be quite characteristic of soils from calcareous or dolomitic materials in this region. It is said that the soil here is about 3 meters above the rock, but there are no outs in the vicinity.

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Table 6. Analyses of Red Latosol. (36)

Sample No.	Horizon	Depth	pH	Organic Matter Carbon	Size Class and Diameter of Particles (*in mm.*)							Other Classes (*in mm.*)		
					Very course sand 2–1	Coarse sand, 1–0.5	Medium sand, 0.5–0.25	Fine sand, 0.25–0.1	Very fine sand, 0.1–0.05	Silt, 0.05–0.002	Clay, <0.002	0.02–0.002	<0.005	>2
		Inches		*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
48816	A_p	0–14	6.1	2.2	1.3	5.8	11.7	18.5	6.8	12.6	43.3	5.2	44.4	0
817	B_2	14–34	5.2	1.7	1.4	4.9	9.3	15.9	6.0	13.4	49.1	5.2	50.7	0
818	B_3	34–40	5.1	0.6	2.0	5.3	8.2	12.1	2.4	15.4	54.6	4.7	55.6	0

Sample No.	Horizon	Depth	Exchangeable Cations me/100 g					Sum of Cations me/100 g	% Base Saturation	Thermal Analysis Data Particle Size Analyzed	Minerals Present Kaolinite	Minerals Present Hydrous oxides*
			Ca	Mg	Mn	K	H				%	%
48816	A_p	0–14	5.1	3.0	0.01	0.4	8.9	17.4	49	<2μ	55	1
817	B_2	14–34	0.5	0.6	0.01	0.2	11.3	12.6	10	<2μ	75	10
818	B_3	34–40	0.3	0.3	0.01	0.2	8.8	9.6	8			

*Presumably Gibbsite.

Congo Soil Profile No. 56

U. S. GOVERNMENT PRINTING OFFICE 16—46512-2

Congo Soil Profile No. 25

SIZE CLASS AND DIAMETER OF PARTICLES (in mm.)

Sample No.	Horizon	Depth	pH	Organic Matter	Very coarse sand 1-2	Coarse sand 0.5-1	Medium sand 0.25-0.5	Fine sand 0.1-0.25	Very fine sand 0.05-0.1	Silt 0.005-0.05	Clay <0.005	Organic Matter	Horizon	Depth	pH	Organic Matter	Very coarse sand 1-2	Coarse sand 0.5-1	Medium sand 0.25-0.5	Fine sand 0.1-0.25	Very fine sand 0.05-0.1	Silt 0.005-0.05	Clay <0.005	Organic Matter
					Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.					Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
48815	A1	0-14	5.1	3.0	0.1	0.8	1.7	15.5	6.8	12.8	43.3	7.4	A3	14-24	5.2	0.9	0.1	0.2	0.4	1.2	12.4	45.1	0.9
815	A2	14-24	5.2	0.9	0.0	0.0	1.3	15.3	6.0	12.4	42.1	2.1	B1	24-40	5.2	0.5	0.0	0.0	0.3	1.2	12.4	54.6	0.5
815	B2	40-72	5.2	0.3	0.0	0.0	0.3	1.3	2.4	12.4	54.6	0.0												

Mineral Analysis Data

Particle Size Analysis of the soil Fraction Passing the 2 mm. Sieve

Sample No.	Horizon	Depth	Sum of Carbonate Bases	% Base Saturation	Exchangeable Cations																			
					Ca		Mg		K		H		Na		Ca		Mg		K		H		Na	
					me/100 g.										lb/A									
48815	A1	0-14	8.8	45	4.0		0.4		0.01		4.3		0.1		8000		800		40		8600		230	
815	A2	14-24	3.8	10	0.8		0.2		0.01		2.8		0.1		1600		400		40		5600		230	
815	B2	40-72	8.8	17	3.0		0.3		0.01		4.3		0.1		6000		600		40		8600		230	

Thermal Analysis Data

Minerals present in the fine sand fraction: Partially analyzed for heavy minerals. Size fraction 0.1-0.25 mm. Analyzed for quartz, feldspar, and limonite-hydrous oxides.

*Presumably dibasic.

Special Sample No.	Horizon	pH
48819	Lower A_p	4.1

White sponge-like material formed by termites

Congo Soil Profile No. 36

Holtson Mr

Special Lysse Sample No. 6388

White sponge-like mesotan laterite gravel to semi-hard Yd lower A1 to A3

I find there is much confusion over this term "dembo". Some say that a real dembo has no stream in it and does have an impervious layer beneath. At least some are dry in the dry season and wet in the rainy season. These are said to have soils similar to the Vlei soils in South Africa. I have seen enough already to indicate that the term has no soil significance.

After lunch I go to visit the copper smelting plant at Elisabethville of the Union Miniere du Haut Katanga with M. de Ryckmans de Betz. This Trust is said to employ about 1,200 Europeans and around 16,000 natives. Of course, only a small part of these people are in Elisabethville. Many work in mines west, and especially northwest.

Here copper ingots are made. I am surprised to see that a good deal of wood is used for fuel in the early stages of the process. Copper ore and iron ore are mixed and then limestone added. After roasting the cindery material goes to the blast furnace where it is mixed with coke. The hot slag is poured off and the hot copper goes first to one converter and then to another. The copper product is somewhat over 95 percent pure. This is shipped partly to the United States and partly to Europe where it undergoes further refinement.

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have been trained to use highly delicate and complicated machinery with competence.

In going around the plant I soon discover that it has been arranged for people who are both small and quick!

I also see the hospital for the natives. This has about 200 beds with the usual biological laboratories, X-ray rooms, operating room, etc. It looks good.

In the early evening Director Jurion and I visit briefly at the home of the head of the local newspaper. He has a beautiful garden with a waterfall, etc. The house is very fine -- really a chateau. The newspaper business must be exceedingly good in Elisabethville!

Later in the evening we go back to the plant in order to see the opening of the big converter and the pouring of the ingots. This is supposed to be a dramatic sight. But I am afraid I am too tired to enjoy it.

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June 25: Near Elisabethville

In the forenoon I go out with M. de Ryckmans de Betz to see the native welfare work at the copper mine of the Union Miniere at Kipushi some 30 kilometers west and a little south of Elisabethville, practically on the border of Rhodesia. The soil along the way is mostly Ground-Water Laterite except for a narrow band of the deep red soil from limestone, a small terrace from mixed material, a few narrow bands of wet alluvial soil, and a few narrow, strongly sloping escarpments. Near Kipushi the Ground-Water Laterite has a pinkish solum a little deeper than most. Some maize is grown by the natives, but it is poor.

First I go to the hospital. This seems to be well staffed and well equipped. The hospital is free to all natives in the area whether they work for the Trust or not! I understand this is common practice with commercial concerns throughout the Congo. All the buildings and grounds are very clean. The management is under Catholic Sisters. Associated with the hospital is a small orphanage for children whose mothers have died.

My attention is drawn particularly to the special care given babies. Of course, the mothers are under the care of physicians for a considerable time before the babies are born, as well as afterwards. All babies are frequently weighed,

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washed, and checked at the hospital. They are given porridge free every day for six years. This is a special measure to counteract polygamy, so I am told. There is a taboo among these natives for the husband and wife to sleep together until after the baby is weaned. Since the natives have no proper food for the babies they may not be weaned for as much as three years. In the meantime, the mother is apt to insist upon the husband's taking another wife because she doesn't want to wean her baby for a long time. By feeding the porridge the babies may be weaned rather soon after birth and, in this way, polygamy has been nearly eliminated.

I also look at the schools. I am told that they are just now changing the educational system with abandonment of the European methods which gave them too high a proportion of half-educated clerks. They begin with the boys when they are very young, say about 2½ or 3 years old, in order to get them away from the influence of superstition given them by their mothers. I am told that the girls are not so easily educated as the boys. I also notice that there is a great deal of "learning of the catechism" by pure memory.

At this mine there are about 2,500 workers and around 600 girls and 600 boys in school. They are now having an average of about 600 births per year.

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I am told that now there is a desperate need for better teachers in order to have their schools improved. Most of the teaching is done by natives, especially with the smaller children.

The older children get some French, but in the new system they will start French much earlier, especially the boys, so they can progress better in the technical work to follow. Since the native languages in the Congo have no technical words, they must learn the French words anyway.

I go over to the place where the food is distributed. The main products distributed include sweet potatoes, corn meal, meat or fish, beans, rice, peanuts, and palm oil. The amounts of the rations are determined by the physicians at the hospital in order that all the people shall have a balanced diet. On different days they go for their rations. This is done principally by the wives. They go once a week for themselves, twice a week for the men, and once a week for the children. Each family is issued appropriate ration

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cards for presentation. By having the rations filled on these different days, there is always food in the house. I am particularly impressed by the long queues. The women must spend a large part of their time in them. They come with an assortment of pans, baskets, and other containers. As they go along they get their rations from the different bins. But the man who passes out the meat is on the inside of the building concealed from view so he won't be able to see who is next in line. This is because some cuts are better than others and they wish to avoid any opportunity for favoritism. Thus, over a period of several days, the poor cuts and the nicer cuts average out.

I go into the compound. Most of the newer houses are made from brick. Part of them have the kitchen attached to the house, but in most it is unattached. A few live in individual houses, but in most instances, two or more are built together. The size of the house for a family depends on the size of the family. I go into some of them. As one would expect, part of them are very clean and neat, and part of them are a great deal less than that. The yards around the houses are not good, partly because of this very infertile yellow Ground-Water Laterite soil.

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on its own merits. Upon retirement most all of them go back to their native village. The Trust builds for them a brick house and gives them a field of about 40 acres, plus about 90 francs a month in cash. Most of them have worked about 20 to 22 years when they are pensioned. But a few are pensioned earlier.

In the mines the cash wages are about 12 to 14 francs per day, plus all the prerequisites, including the food for the whole family, housing, certain allowances for clothing, medical care, schools, etc. At the present time, the Trust is spending about 45 francs per day for their workers. The more skilled workers get somewhat higher wages and these are given credit towards pensions in excess of 90 francs per month.

Just as we are leaving I go by the boys' school. This is not nearly so neat as the girls' school that I saw earlier. But it is to be rebuilt in order to accommodate the newer system of teaching that is to be put in soon.

We drive back to Elisabethville where I am entertained at a very nice luncheon at the "Club".

Immediately after lunch I drive several kilometers south of Elisabethville to a flat treeless area ("dembo") on the other side of Kafubu Creek from the site of the new INÉAC station. I first look at the soil near the margin of the treeless area under a cover of thin shrubs, grass, and low trees.

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The land is nearly flat and is imperfectly drained.

A_1	0 - 1"	Yellowish-gray fine sandy clay loam; hard but friable.
A_2	1 - 8"	Grayish-yellow fine sandy clay loam; hard; digs out in irregular blocky; very hard to crush.
A_3	8 - 17"	Yellowish-brown fine sandy clay; digs out in hard medium blocky.
B_1	17 - 28"	Yellowish and reddish-brown compact mixture of fine sandy clay and dark red lateritic concretions.
B_2	28 - 46"	Mottled dark red, orange-red, and yellow compact fine sandy clay; semi-indurated into a lateritic hardpan.
B_3	46 - 55" plus	Mottled red, gray, and yellow fine sandy clay; not quite so hard as the above.

Some roots penetrate to the B_2. I still should regard this soil as a yellow Ground-Water Laterite.

About 100 feet away I look at the soil hurriedly in a narrow grassy stream channel with a water table at 40 inches.

A_1	1 - 7"	Medium-gray silty clay, slightly mottled and streaked with yellowish-brown. The soil is in rather hard large blocky pieces that are fairly easily friable.
G_1	7 - 15"	Silty clay mottled with gray, yellowish-brown, and yellow; firm, but easily friable; many roots.
G_2	15 - 30"	Light gray silty clay mottled with yellowish-brown; firm; many roots.
G_3	30 - 40" plus	Sticky mottled gray and yellow clay; wet; hardens on drying.

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G_3	30 - 40" plus	Sticky mottled gray and yellow clay; wet; hardens on drying.

I walk out into a flat place that is said to be a typical dry dembo. The cover is nearly all grass, but there are a very few small stunted trees. Here there are some small light gray termite mounds. These are about 12 to 18 inches high and some 6 to 8 inches in diameter.

Soil Profile Sample No. 37

A_1 and A_2	0 - 6"	Light gray (very light gray when dry) very fine sandy clay; digs out in fairly easily friable irregular blocky.
A_3	6 - 8"	Like the above, slightly mottled with yellowish-brown.
B_1	8 - 18"	Gray gravelly (concretionary) fine sandy clay mottled with yellowish-brown and reddish-brown. Light gray when dry.
B_2	18 - 24" plus	Firm mixture of fine sandy clay and lateritic concretions, mottled with yellow and yellowish-brown. Mainly light gray when dry.

Roots go just into the B_2. The soil is now moist in the lower part but exceedingly dry in the upper 6 inches. It is said that the water table is at the surface during the rainy season. It is too bad that there was not time to have the profile prepared more deeply. The sample is incomplete, but I should regard this soil as certainly the tropical equivalent of the Planosol. The parent material is probably identical to that under sample No. 34 -- schist.

We drive back to the site of the experiment station and find we just have time to look at a pit about 3 or 4 kilometers south of Elisabethville which I had requested the first day.

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K-1427 June 25, 1947
Belgian Congo. About 15 kilometers southeast of Elisabethville. View in dry "dembo" with gray Ground-Water Laterite. Note small light gray termite mounds and very few stunted savanna trees. (Site of profile sample No. 37.)

K-1127 June 25, 1947
Belgian Congo. About 15 kilometers southeast of
Elisabethville. View in dry "dambo" with gray
Ground-Water Laterite. Note small light gray
termite mounds and very few stunted savanna trees.
(Site of profile sample No. 37.)

The area is very slightly depressed, dry now but wet during the rainy season.

XIV

A_1	0 - ½"	Dark gray mulch of loose very fine sandy loam.
A_2	½ - 4"	Slightly yellowish, gray hard brittle fine sandy loam; porous; digs out in chunks that are fairly easily friable.
A_{30}	4 - 8"	Pale yellow fine sandy loam, compact but friable.
A_{31}	8 - 13"	Like the above, but yellow.
A_{32}	13 - 34"	Yellow heavy fine sandy loam with orange-red soft concretions becoming harder and more numerous in depth.
B_1	34 - 40"	Semi-indurated mass of grayish-yellow sandy clay and red lateritic concretions.
B_2	40 - 52"	Mottled reddish-brown, gray, and black indurated lateritic hardpan.
B_3	52 - 55" plus	Like the above, but with somewhat larger mottling. (Special sample taken.)

The roots go to the B_2. The soil is moist below the A_2. There is every reason to believe that the parent material is schist.

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Thus in this region around Elisabethville I have seen the following types of soil:

Deep red lateritic soil from limestone

Deep pinkish-red Ground-Water Laterite

Thin pinkish-red Ground-Water Laterite

Yellow Ground-Water Laterite

Gray Ground-Water Laterite

Gray hydromorphic (poorly to imperfectly drained soils)

Black-gray Half-Bog

Deep orange-red or red lateritic soil from mixed materials on terraces

Then, of course, there are truncated associates of these, but on the whole, there is very little erosion in the region. In fact, that is the chief thing that is the matter with the soils. Had the land been hilly and erosion more active, the soils would have been very much more productive.

It is most unfortunate that practically all of the wild land -- and most of the land is wild land -- burns every year.

It is completely dark by the time we get back to the hotel; and then another special dinner before bed.

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June 26: Elisabethville to Kamina
and to Kaniama

Director Jurion and I are up at 5 o'clock to take the early plane to Kamina. We are at the airport at 6:30 but have some delays. Our plane is a small six-passenger Renault. We are in the air at 6:55. We pass over a plain of thin forest with low hills and ridges. I see a few open areas in depressions and on very narrow strips of alluvium. I see only a very little cultivation.

There is a little cultivation near Kapeshi. Some of the land is locally rolling and there is a little low dissection. Just before Kolwezi we fly over a rolling and undulating plain with quite a bit of cultivation. There are large mines in the neighborhood and our plane lands. Here, in the Congo, there is now an uncomfortably cold east wind! The airport is on gray Ground-Water Laterite with a fairly deep fine sandy loam surface soil.

After Kolwezi there is thin forest and grass with some nearly open places and a little cultivation. I see a few low hills and ridges and mild dissection.

Near Zilo the land is strongly rolling and hilly to the east, but undulating and gently rolling to the west. Beyond Busanga, we pass over somewhat less open forest.

Just before reaching Kamina we come over a high plain with short grasses and narrow gallery forests. We are down at 9:42 a.m.

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There is a little cultivation near Kapeshi. Some of the land is locally rolling and there is a little low dissection. Just before Kolwezi we fly over a rolling and undulating plain with quite a bit of cultivation. There are large mines in the neighborhood and our plane lands. Here, in the Congo, there is now an uncomfortably cold east wind! The airport is on gray Ground-Water Laterite with a fairly deep fine sandy loam surface soil.

After Kolwezi there is thin forest and grass with some nearly open places and a little cultivation. I see a few low hills and ridges and mild dissection.

Near Zilo the land is strongly rolling and hilly to the east, but undulating and gently rolling to the west. Beyond Busanga, we pass over somewhat less open forest.

Just before reaching Kamina we come over a high plain with short grasses and narrow gallery forests. We are down at 9:42 a.m.

At the airport the soil is gray, sandy, and imperfectly drained. In the neighborhood are many nearly wet places. Kamina is on a plateau of the Kalahara sands like those of South Africa. (These gray sand beds and the underlying sandstones are very important in the whole southwestern Congo. In fact, the formation extends north into French Equatorial Africa west of Brazzaville.)

I go out south of Kamina with M. van der Straeten. I am told that this plateau is the largest one in the region characteristic of the Kalahara[a] sands. Most of the others are smaller. There is a series of terraces from the plateau to the river bottoms. Some geologists believe that these original gray loose sands that form the upper strata of the Kalahara series may be of aeolian origin. These soils are used largely for cattle production.

Two or three kilometers south of Kamina I look at the soil in a rather shallow pit on the top of the plateau. I am sorry that the pit has not been made more deeply, but there is no help for it now and I take samples of the upper horizons. The land is nearly level and mainly savanna with a few scattered shrubs. There are some fields of cassava.

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Soil Profile Sample No. 38

A_1	0 - 3"	Dark gray light sandy loam; many roots; very dry; digs out in easily friable chunks that fall almost into single grain.
A_3	3 - 20"	Gray light sandy loam with a sprinkling of pink sand; massive in place; brittle; easily friable to a mixture of single grain and poor granular. Brown when dry.
B	20 - 26" plus	Grayish-yellow, with much pink, loamy sand; firm in place, but easily friable. (Perhaps this horizon should be regarded as C_1.) Pink to light brown when dry.

Then I go on to a terrace with a surface of red loam and red sandy loam. Here I see some striking termite mounds of pinkish-red color. They are about 6 to 8 feet in diameter and 12 to 16 feet high. These terraces are apparently younger and newer formations than the high wind-blown plateaus. In a few places I see purplish Kalahara sandstone of which the upper part is laterized. This lateritic layer lies just a few feet beneath the red sandy loam solum. On the terraces there are somewhat more shrubs and trees. I also see some outcrops of pink Kalahara sandstone said by geologists to have been silicified on the surface during Miocene times.

Still lower down the deeper dissection has uncovered diorite. In fact, these rocks may outcrop in the lower stream beds. I see some narrow bands of red soil from diorite on

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K-1428 June 26, 1947
Belgian Congo. About 2 or 3 kilometers south of Kamina. Landscape on plateau of sandy soil from Kalahara sands. Natural savanna with characteristic small trees. (Site of sample No. 38.)

K-1128 June 26, 1917
Belgian Congo. About 2 or 3 kilometers south of
Kamina. Landscape on plateau of sandy soil from
Kalahara sands. Natural savanna with characteristic
small trees. (Site of sample No. 38.)

K-1525 June 26, 1947
Belgian Congo. Near Kamina, termite mound about 16 feet tall on red soil.

K-1525 June 26, 1917
Belgian Congo. Near Kamina, termite mound about
16 feet tall on red soil.

well-drained terraces near the streams. The very surface soil is dark reddish-brown to nearly black. Vegetables, papaya, and citrus are grown on these soils under irrigation.

I look hurriedly, on the way back to Kamina, at one of the sandy soils on the terrace below the plateau. There are tall savanna grasses with scattered shrubs and trees on the undulating terrace.

A_1	0 - 6"	Slightly reddish, brown, rather loose loamy sand.
B	6 - 20"	Reddish-brown light sandy loam; compact, but easily friable.
C	20 - 200" plus	Red light sandy loam.

Thus the old plateaus have soils developed from the Kalahara sands -- gray sands. These are surrounded by the red sandy soils on high terraces which are underlain, generally, by the pink sandstone of the lower Kalahara. These old terraces are often in several steps. Beneath them are terraces with good soil developed from a mixture of the Kalahara materials and diorite. Finally, next to the streams, are young alluvial soils strongly influenced by diorite.

Unfortunately I have hardly 2 hours in the field here.

Director Jurion and I have lunch with several agriculturists at the home of M. Huwart.

We leave in a hired car for Kaniama about two o'clock. We shall need to go very fast in order to make it by nightfall.

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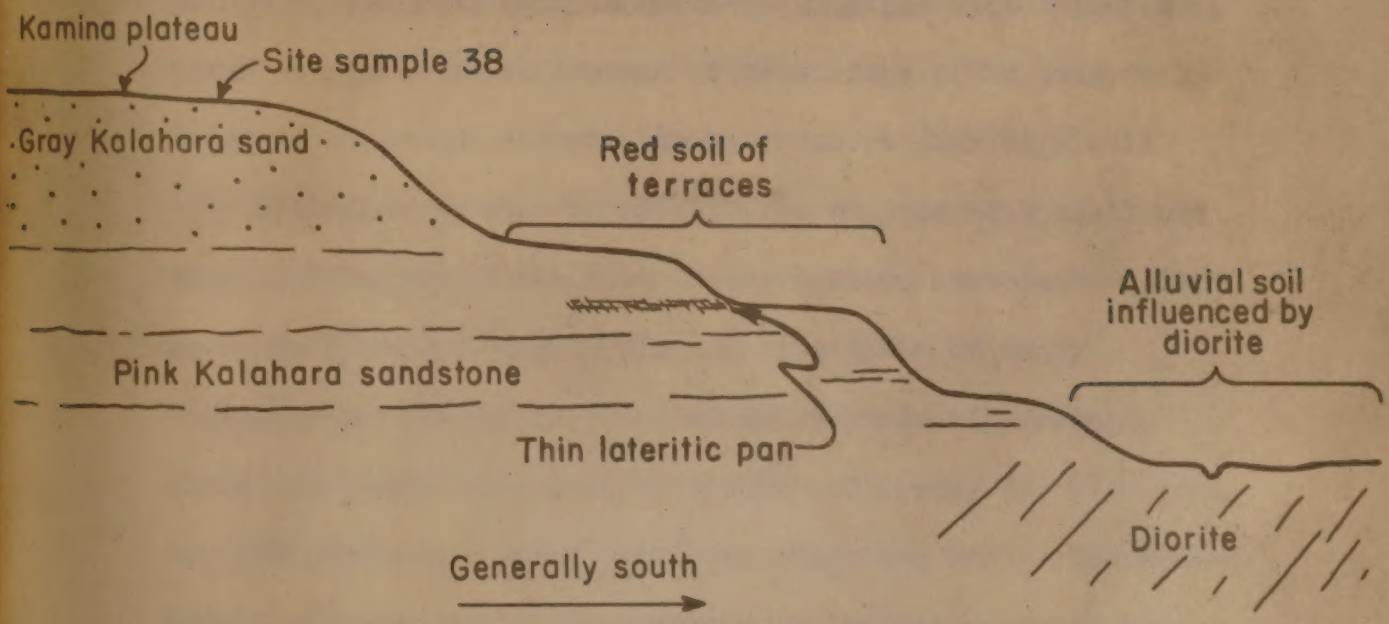

Schematic cross-section from plateau of Kalahara sand to deep diorite

Soils are improved by such geological dissection.

Shortly after leaving Kamina we are out on the plateau on a slightly higher elevation than the place where sample No. 38 was taken. We see savanna fires here and there over the plains. A great pity! But apparently no practical way has been devised to stop them.

The landscape reminds me a bit of the thin scrub oak plains of Grayling sand in northern Michigan except that here there is coarse grass instead of sweet fern. Now everything is dry. There are essentially no crops on this high soil.

From time to time on this route, we pass both small and very large areas of the imperfectly drained associate. Within these areas there are often smaller spots of sandy Wiesenboden. The poorly drained and imperfectly drained areas are essentially free of shrubs and trees.

We pass a few native villages along the road. The men have employment on the highway and on the railroad and some food crops and cotton are grown in the valleys rather far to the side. Director Jurion tells me that there is a good deal of this sandy soil in the southwestern Congo.

In a few places we drop into areas of sloping land down to a stream and then go back up on to the plateau. Many of the soils on the slopes are developed from the deep pink sandstone. These soils are somewhat more productive. I see some good cattle grazing on them. They have a few more and

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larger trees, and larger and redder termite mounds.

At about 35 miles we turn north near the railroad on gently rolling red sandy loam or sandy clay loam. Here there is fair pasture and some cassava. But when we pass Katongola we are again on the sandy plateau with grass and a few scattered trees. Just beyond, we pass over a large area of dark gray sandy Wiesenboden with very heavy grass. In such places the road is completely covered with a short grass that stabilizes it -- even the wheel tracks. Here we have a little trouble because some of this grass in the roadway has caught fire. Of course, these fires have to be put out before it will be safe for us to travel.

Just before Muleba we pass over some of the slightly higher gray sandy loam and then again come into the dark gray sandy Wiesenboden. This has dark gray loamy sand to more than 18 inches with fairly good grass where there are small black termite mounds about 1 to 3 inches in diameter and 5 to 12 inches high. Once one had worked out the relationships, I think he could go quite a long ways in identifying soils in the Congo by the shape, height, color, and density of these termite mounds.

About six miles north of Muleba we are on the somewhat better red soils developed from orange-red clay probably weathered in place from igneous rocks -- possibly syenite.

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But most of the soils along here for a considerable distance are developed from the pink Kalahara sandstone.

Some 18 miles north of Muleba we enter a relatively open gently rolling plain with savanna, scattered shrubs, and trees, and some gallery forest. In the ravines there is fairly heavy soil with lateritic hardpan exposed in places. On a little way farther I see bright orange-red lateritic soils with dark red concretions on the undulating uplands. As we go north this soil changes to red. I wonder if we are now back with our old friend "Red Loam". But there is very little cultivation except for a few patches of cassava. Most of the termite mounds are low, about 3 to 6 feet high, although occasionally I see a tall slender one.

About six miles south of Kimpanga I look at the soil on an undulating plain. The cover is mostly savanna with a few gallery forests in the ravines. The soil is now exceedingly dry.

A_1	0 - 7"	Pinkish-red sandy clay; nearly massive in place, but digs out in irregular nut, friable under pressure.
A_3	7 - 24"	Slightly lighter, pinkish-red sandy clay; some vertical cracking.
B_2	24" plus	Mixture of dark pinkish-red sandy clay and dark red concretions.

In depths from 36 to 60 inches these concretions are hardened into a continuous lateritic hardpan.

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I see essentially the same soil north of Kimpanga and west. Most of the agriculture is confined to small patches of cassava on the slopes at the margin of the gallery forests.

A little way after crossing the Lubishi River, the land is somewhat more rolling. A few oil palms and bananas appear in favored places. Although we pass a few large villages, most of the land is wild.

South of Tshikamba the soil is dark reddish-brown in the surface and dark red underneath, with concretions and lateritic hardpan. The cover is mixed savanna, shrubs, and scattered trees.

Our native driver can apparently drive only at one speed--about 40 miles an hour, which is about 10 miles an hour too fast for these rough country roads. The fan belt breaks and we get a little rest while the driver puts on a new one.

We pass through Tshikamba at six o'clock, just as the sun goes down. A mile north of this village we pass through a narrow belt of grayish-brown soil with many large granitic boulders on the surface. Here the termite mounds are small, but I have never seen them so thick elsewhere. I wonder why they are so thick on the granitic soil here while there were practically none near Nioka. Beyond this narrow belt of rolling land from the granite, we are back on the undulating red soil with concretions. I see some ripe maize, a few oil

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K-1429 June 26, 1947
Belgian Congo. A little way south of Tshikamba. Savanna on dark reddish-brown surface surface soil over soil with dark red concretions, then laterite crust beneath.

K-1429 June 26, 1947
Belgian Congo. A little way south of Tshikamba.
Savanna on dark reddish-brown surface surface
soil over soil with dark red concretions, then
laterite crust beneath.

palms, cassava, and some bananas.

As we go north the wild vegetation becomes more dense; the number of villages increases; and I see more and better food crops and cotton. The gallery forests are wider and there are more savanna trees in the land between them.

We arrive at Kaniama at 6:45. Very tired. We had a very poor driver this afternoon.

We stay with M. and Mde. Herman and have an excellent dinner. M. Herman is much interested in forestry. He is the representative of the Comitè Special du Katanga.

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June 27: Kaniama[a]

Director Jurion and I plan to spend this day with the soil survey party working near Kaniama on the red lateritic soils from granite and basic rocks. The chief of the party is M. A. Focan.

We first drive out north of the railway station and look at the soil about 2 kilometers from the station. This first site is on a slope of about 5 percent and extends down to a small stream. There are granite outcrops near the top and diorite in the stream bed. It is thought that the profile is probably developed from weathered diorite with perhaps some contributions from the granite. For a considerable time this tract of land was devoted to arabica coffee. Now it is in a shrubby legume cover crop.

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K-1430 June 27, 1947
Belgian Congo. 4 kilometers northwest of Kaniama railway station. Savanna on yellowish-brown soil from granite. Near site of soil profile sample No. 39.

K-1130 June 27, 1947
Belgian Congo. 4 kilometers northwest of Kamisma railway station. Savanna on yellowish-brown soil from granite. Near site of soil profile sample No. 39.

A_P	0 - 6" (5-11")	Reddish-brown clay loam to clay with irregular nut and granular structure. The soil is now very dry and quite hard. There are a few vertical cracks.
B_1	6 - 22" (20-25")	Dark red gravelly clay; firm in place; digs out in irregular poor blocky, friable with difficulty. The pebbles are partly weathered quartzite and partly lateritic concretions, which, I suspect, have been washed in.
B_2	22 - 40"	Compact red gravelly sandy clay.
B_3	40 - 62"	Red gravelly sandy clay more friable than the above and with less gravel.
C	62 - 72" plus	Mottled red and yellow sandy clay with some concretions; firm in place, but friable when removed.

Roots extend on to 60 inches. The soil is obviously permeable to both roots and water.

I look at another profile pit one kilometer farther up the slope. The vegetation is similar to the previous site and the slope is about $2\frac{1}{2}$ percent.

A_P	0 - 6"	Dark brown sandy clay loam; easily friable to coarse rather hard granular; many roots. (In the old holes made for the coffee trees the A_P extends to 30 inches.)
A_3	6 - 11"	Reddish-brown sandy clay loam; digs out in easily friable irregular nut.
B_2	11 - 25"	Red sandy clay; firm; digs out in medium irregular nut, friable under hard pressure.
C	25 - 75" plus	Slightly orange, red sandy clay loam, friable and rather soft; pervious; a very few small concretions.

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Roots extend on to 60 inches. The soil is obviously permeable to both roots and water.

I look at another profile pit one kilometer farther up the slope. The vegetation is similar to the previous site and the slope is about 2½ percent.

A_p	0 - 6"	Dark brown sandy clay loam; easily friable to coarse rather hard granular; many roots. (In the old holes made for the coffee trees the A_p extends to 30 inches.)
A_3	6 - 11"	Reddish-brown sandy clay loam; digs out in easily friable irregular nut.
B_2	11 - 25"	Red sandy clay; firm; digs out in medium irregular nut, friable under hard pressure.
C	25 - 75" plus	Slightly orange, red sandy clay loam, friable and rather soft; pervious; a very few small concretions.

The roots go to 72 inches. I suspect that the parent material came from granite and diorite mixed. Although this soil seems entirely permeable, roots are much thicker in the old holes made for the coffee trees, which were filled with A_1, than elsewhere.

We then drive to the survey camp. At the headquarters rough mechanical analyses are made together with pH determinations and estimates of the percentage of concretions. They recognize three general groups of soils here:

(1) Soils from granite, generally gray in the surface and yellow beneath. The pH is about 5.

(2) Red soils from basic rocks. The pH is about 6. These are the best soils for agriculture.

(3) Degraded soils from basic rocks with a pH of about 5. These soils are poor.

This survey is being made as a part of the program for making soil surveys of representative areas within important soil regions throughout the Congo. Since there is a good deal of unoccupied land in this region, a tentative plan is being discussed for settlement of European farmers here. INÉAC is also planning to establish an experiment station for this region near Kaniama. The soil survey will be needed for planning settlement and locating the station.

Unfortunately, the party does not have aerial photographs. In fact, they have almost no base maps to start with. They need to run a good many base lines with the chain and compass.

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survey a reconnaissance. In addition to mapping the soil, the botanist also maps the vegetation separately. Samples of all recognized species of plants are sent to Yangambi and to Brussels for positive identification or checking. The botanical composition of each plant association is determined in the field.

There are 100,000 hectares in this survey area and they expect to be another year at the work. In addition to the party chief, who is a soil scientist, there is one other soil surveyor (now on leave to get married), a botanist, and a topographer. The party uses 65 native helpers. These are each paid 75 francs per month salary plus food and clothing. Food for the native and his family runs about 100 francs per month. They are also furnished huts. All soil examinations are made in holes dug by the native helpers. For areas like this such helpers are essential because the soils must be examined to at least 6 feet, and often more, and many of the excavations are made only with great difficulty. All lines through the gallery forests must be cut. One doesn't just "walk through" the native forests in the Congo.

After this short conference at the survey headquarters, we again go out to the field along with several native helpers.

We stop on a smooth area of upland with 1 or 2 percent slope and look at a yellow lateritic soil developed from granite

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After this short conference at the survey headquarters, we again go out to the field along with several native helpers.

We stop on a smooth area of upland with 1 or 2 percent slope and look at a yellow lateritic soil developed from granite

under savanna with some shrubs and dwarf trees. This is about 4 kilometers northwest of the railway station.

Soil Profile Sample No. 39

A_{10}	0 - 1½"	Dark gray granular sandy clay; individual granules hard and dry.
A_{11}	1½ - 4"	Dark grayish-brown sandy clay; firm, but digs out in clods easily friable to hard granular. (To purplish gray when dry)
A_{30}	4 - 8"	Dark yellowish-brown sandy clay like above. Reddish-brown when dry.
A_{31}	8 - 24"	Yellowish-brown coarse sandy clay; firm, but when dry easily friable to coarse singlegrain sand and hard granules. Light reddish-brown when dry. Grades into:
B_2	24 - 42"	Dark yellow coarse sandy clay. Quite firm but falls into coarse sand and hard granules. Reddish-yellow to yellowish-red when dry.
C	42 - 60" plus	Dark yellow to reddish-yellow coarse sandy clay. Like the above, but with some pebbles of rotten granite and a few small concretions. Reddish-yellow when dry.
D		Pink coarse-grained granite at considerable depth. A rock sample is taken in a nearby outcrop on a small sharp knoll.

The roots go down to the C.

I look at another pit on a lower slope where there has been some sorting. There are less pebbles and less coarse sand. Probably there has been some alluvial wash here. The slope is about 1½ percent. The cover is mixed savanna and thin savanna trees.

under savanna with some shrubs and dwarf trees. This is about 4 kilometers northwest of the railway station.

Soil Profile Sample No. 39

A_{10}	0 - 1½"	Dark gray granular sandy clay; individual granules hard and dry.
A_{11}	1½ - 4"	Dark grayish-brown sandy clay; firm, but digs out in clods easily friable to hard granular. (To purplish gray when dry)
A_{30}	4 - 8"	Dark yellowish-brown sandy clay like above. Reddish-brown when dry.
A_{31}	8 - 24"	Yellowish-brown coarse sandy clay; firm, but when dry easily friable to coarse singlegrain sand and hard granules. Light reddish-brown when dry. Grades into:
B_2	24 - 42"	Dark yellow coarse sandy clay. Quite firm but falls into coarse sand and hard granules. Reddish-yellow to yellowish-red when dry.
C	42 - 60" plus	Dark yellow to reddish-yellow coarse sandy clay. Like the above, but with some pebbles of rotten granite and a few small concretions. Reddish-yellow when dry.
D		Pink coarse-grained granite at considerable depth. A rock sample is taken in a nearby outcrop on a small sharp knoll.

The roots go down to the C.

I look at another pit on a lower slope where there has been some sorting. There are less pebbles and less coarse sand. Probably there has been some alluvial wash here. The slope is about 1½ percent. The cover is mixed savanna and thin savanna trees.

Table 13. Analyses of Yellow Latosol. (39)

Sample No.	Horizon	Depth	pH	Organic ~~Matter~~ Carbon	Size Class and Diameter of Particles (*in mm.*)							Other Classes (*in mm.*)		
					Very coarse sand 2–1	Coarse sand, 1–0.5	Medium sand, 0.5–0.25	Fine sand, 0.25–0.1	Very fine sand, 0.1–0.05	Silt, 0.05–0.002	Clay, <0.002	0.02–0.002	<0.005	>2
		Inches		*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
48827	A_{10}	0-1½	6.0	2.0	13.6	23.8	12.2	12.7	3.8	6.3	27.6	2.6	28.2	0
828	A_{11}	1½-4	5.6	1.4	13.0	21.6	11.6	12.8	3.9	5.2	31.9	2.4	32.5	0
829	A_{30}	4-8	5.0	0.9	14.5	18.9	10.8	13.1	3.4	4.8	34.5	1.9	34.8	0
830	A_{31}	8-24	5.0	0.6	17.2	15.4	8.6	11.3	3.6	4.8	39.1	2.6	39.8	0
831	B_2	24-42	5.3	0.3	17.8	11.2	4.8	7.6	3.3	4.9	50.4	2.9	51.2	0
832	C	42-60	5.4	0.3	24.6	9.0	3.3	4.7	3.2	4.8	50.4	2.8	51.1	0

			Exchangeable Cations me/100 g					Sum of Cations me/100 g	% Base Saturation
			Ca	Mg	Mn	K	H		
48827	A_{10}	0-1½	4.3	1.0	0.04	0.3	5.0	10.6	53
828	A_{11}	1½-4	2.1	0.5	0.02	0.1	5.6	8.3	33
829	A_{30}	4-8	0.4	0.1	0.03	< 0.1	6.0	6.5	8
830	A_{31}	8-24	0.1	< 0.1	0.01	< 0.1	5.0	5.1	2
831	B_2	24-42	0.1	< 0.1	0.01	< 0.1	4.7	4.8	2
832	C	42-60	0.3	0.1	0.03	< 0.1	4.5	4.9	9

Congo Soil Profile No. 39

U. S. GOVERNMENT PRINTING OFFICE 16—46512-2

Congo Soil Profile No. 39

SIZE CLASS AND DIAMETER IN MILLIMETERS (mm.)

SAMPLE No.	HORIZON	DEPTH	pH	Organic carbon	Very coarse sand 2-1	Coarse sand 1-0.5	Medium sand 0.5-0.25	Fine sand 0.25-0.1	Very fine sand 0.1-0.05	Silt 0.05-0.002	Clay <0.002	OTHER CONSTITUENTS (mm.) 0.02-0.002	<0.005	<2
4827	A	0-17	6.0	0.81	12.6	22.8	15.8	17.1	8.8	6.2	27.6	0.0	38.2	0
828	A	17-43	5.6	1.46	12.0	13.6	10.8	12.8	8.4	5.2	31.6	4.4	32.2	0
829	A	43-80	5.2	0.62	14.2	12.6	10.8	12.2	8.4	4.8	32.8	7.4	34.8	0
830	AB	80-120	5.2	0.32	12.0	11.2	8.8	11.2	8.4	4.8	34.4	8.8	37.8	0
831	B	120-150	5.0	0.32	8.4	7.4	4.8	7.6	8.4	4.8	50.4	8.8	51.2	0
832	C	150+	4.2	0.0	9.8	8.8	5.2	7.6	8.4	4.8	50.4	8.8	51.2	0

Mechanical Analysis

Depth	Fine gravel 10-5	Coarse gravel 5-2	Very coarse sand 2-1	Coarse sand 1-0.5	Medium sand 0.5-0.25	Fine sand 0.25-0.1	Very fine sand 0.1-0.05	Silt 0.05-0.002	Clay <0.002
	Percentage Centesimal Fractions of Fine Earth Dried at 105° C.								
0-17	0.0	0.0	12.5	22.8	15.8	17.1	8.8	6.2	27.6
17-43	0.0	0.0	12.0	13.6	10.8	12.8	8.4	5.2	31.6
43-80	0.0	0.0	14.2	12.6	10.8	12.2	8.4	4.8	32.8
80-120	0.0	0.0	12.0	11.2	8.8	11.2	8.4	4.8	34.4
120-150	0.0	0.0	8.4	7.4	4.8	7.6	8.4	4.8	50.4
150+	0.0	0.0	9.8	8.8	5.2	7.6	8.4	4.8	50.4

A_{10}	0 - 4½"	Very dark gray to black granular sandy clay.
A_{11}	4½ - 9½"	Dark grayish-brown granular sandy clay.
A_3	9½ - 14"	Dark yellowish-brown sandy clay; transitional.
B_1	14 - 26"	Yellowish-brown sandy clay; firm in place, but fairly easily friable to coarse granular.
B_2	26 - 48"	Dark yellow sandy clay; friable; a little coarse sand.
C	48 - 72" plus	Brownish-yellow sandy clay; softly granular and moist; a few small concretions.

Roots extend the entire depth.

A little farther down the slope and near a stream, I look at a similar profile on the margin of the gallery forest, which is only a trifle more red.

I walk into the gallery forest, cross a small stream, and go up the slope on the other side. I look at a profile in the forest where the slope is about 7 percent.

A_1	0 - 6"	Very dark red clay; digs out in clods; quite easily friable to small hard granular.
B_1	6 - 16"	Dark brownish-red gravelly clay; quite hard in place; digs out in irregular nut; high proportion of concretions.
B_2	16 - 48"	Deep red mixture of clay and concretions. About one-half of the mass is irregularly semi-indurated.
C	48 - 70" plus	Like the above, but mottled with ocher yellow.

The concretions have an ocher colored streak. The parent material is probably diorite. Roots go to about 40 inches.

A_{10}	0 - 4½"	Very dark gray to black granular sandy clay.
A_{11}	4½ - 9½"	Dark grayish-brown granular sandy clay.
A_3	9½ - 14"	Dark yellowish-brown sandy clay; transitional.
B_1	14 - 26"	Yellowish-brown sandy clay; firm in place, but fairly easily friable to coarse granular.
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B_2	16 - 48"	Deep red mixture of clay and concretions. About one-half of the mass is irregularly semi-indurated.
C	48 - 70" plus	Like the above, but mottled with other yellow.

The concretions have an outer colored streak. The parent material is probably diorite. Roots go to about 40 inches.

I notice along the steeper parts of the slope within the gallery that lateritic hardpahs are exposed. I continue on up the slope to the undulating upland beyond and look at a pit with red soil developed probably from basic rocks on a slope somewhat less than 2 percent. The cover is savanna and scattered dwarf trees, freshly burned.

A_1	0 - 6"	Very dark reddish-brown to nearly black clay loam; digs out in small clods easily friable to granular.
A_3	6 - 10"	Transitional.
B_1	10 - 16"	Very dark red clay; rather easily friable to a mixture of granular and irregular blocky.
B_2	16 - 40"	Red to dark red clay; firm in place, but easily friable to granular.
C	40 - 65" plus	Softly granular (mellow) red to dark red clay; very few concretions.

This profile is very dry down to 60 inches. Roots penetrate to the full depth of the profile -- 65 inches. There are many insect holes in the upper three feet. There are some vertical cracks in the upper part.

One side of the pit discloses buried pottery at two feet. Not like some other underpopulated places in the Congo, it appears that many years ago there was a dense population here that may have been destroyed by sleeping sickness.

Nearby I look at a similar profile. We are about $5\frac{1}{2}$ kilometers northwest of the railway station. The soil is essentially the same, but I think this is a better place to take a sample.

I notice along the steeper parts of the slope within the gallery that lateritic hardpans are exposed. I continue on up the slope to the undulating upland beyond and look at a pit with red soil developed probably from basic rocks on a slope somewhat less than 2 percent. The cover is savanna and scattered dwarf trees, freshly burned.

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One side of the pit discloses buried pottery at two feet.

Not like some other underpopulated places in the Congo, it appears that many years ago there was a dense population here that may have been destroyed by sleeping sickness.

Nearby I look at a similar profile. We are about 5½ kilometers northwest of the railway station. The soil is essentially the same, but I think this is a better place to take a sample.

Soil Profile Sample No. 40

A_1	0 - 5"	Very dark reddish-brown clay loam; granular and irregular nut. Dark reddish-brown when dry.
A_3	5 - 11"	Reddish-brown clay; digs out in chunks that break into hard large irregular granular. Red when dry.
B_1	11 - 17"	Very dark red clay; transitional. Strong red when dry.
B_2	17 - 37"	Dark red clay; firm in place, but fairly easily friable. Strong red when dry.
C	37 - 48" plus	Softly granular (mellow) dark red clay. Strong red when dry.

The parent rock is probably diorite or quartz diorite./a

Our hike in the "bush" is about over at one o'clock and I am hot, thirsty, and tired. We have a very heavy lunch at the soil survey camp, which is an old brick plantation house with a thatched roof.

I am told there are about 10 European farms in this general region. The chief crops are coffee, tobacco, vegetables, oranges, mandarins, and grapefruit. The natives grow peanuts, cassava, maize, and some bananas, grain sorghums, and oil palm.

The European farmers have some cattle, but the natives have only goats, hairy sheep, and chickens.

/a Added later: In an adjacent stream collected rock sample identified in laboratory by Dr. Humbert as quartz diorite leaning toward diorite.

Soil Profile Sample No. 40

A_1	0 - 5"	Very dark reddish-brown clay loam; granular and irregular nut. Dark reddish-brown when dry.
A_3	5 - 11"	Reddish-brown clay; digs out in chunks that break into hard large irregular granular. Red when dry.
B_1	11 - 17"	Very dark red clay; transitional. Strong red when dry.
B_2	17 - 37"	Dark red clay; firm in place, but fairly easily friable. Strong red when dry.
C	37 - 48" plus	Softly granular (mellow) dark red clay. Strong red when dry.

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[a] Added later: In an adjacent stream collected rock sample identified in laboratory by Dr. Humbert as quartz diorite leaning toward diorite.

Table 3. Analyses of Red Latosol. (40)

Sample No.	Horizon	Depth	pH	Organic ~~Matter~~ Carbon	Size Class and Diameter of Particles (*in mm.*)							Other Classes (*in mm.*)		
					Very course sand 2–1	Coarse sand, 1–0.5	Medium sand, 0.5–0.25	Fine sand, 0.25–0.1	Very fine sand, 0.1–0.05	Silt, 0.05–0.002	Clay, <0.002	0.02–0.002	<0.005	>2
		Inches		*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
48834	A_1	0–5	5.8	4.5	2.2	6.2	9.1	16.3	5.8	15.1	45.3	10.6	49.8	0
835	A_3	5–11	5.4	1.8	2.9	7.1	7.3	13.2	4.7	12.0	52.8	8.4	56.7	0
836	B_1	11–17	5.3	1.4	2.0	4.6	4.2	7.7	3.3	9.7	68.5	7.2	71.7	0
837	B_2	17–37	5.6	0.7	1.7	4.2	4.8	9.6	4.0	11.6	64.1	8.3	67.7	0
838	C	37–48+	5.6	1.0	3.5	5.1	5.1	9.6	3.9	10.0	62.8	7.1	66.2	0

Sample No.	Horizon	Depth	Exchangeable Cations me/100 g					Sum of Cations me/100 g	% Base Saturation	Thermal Analysis Data: Particle Size Analyzed	Minerals Present: Kaolinite	Minerals Present: Hydrous oxides*
			Ca	Mg	Mn	K	H				%	%
48834	A_1	0–5	10.5	3.6	0.09	0.5	13.9	28.6	51	<2μ	60	5
835	A_3	5–11	2.7	0.9	0.07	0.1	11.5	15.3	25			
836	B_1	11–17	1.7	0.5	0.17	<0.1	9.8	12.2	19			
837	B_2	17–37	1.8	0.3	0.15	<0.1	7.8	10.0	22	<2μ	70	10
838	C	37–48+	2.1	0.5	0.07	<0.1	6.5	9.2	29	<2μ	70	10

Sample No.	Horizon	Depth	Total P	Available P
			Pct.	ppm.
48834	A_1	0–5	.076	9
835	A_3	5–11	.045	4
837	B_2	17–37	.040	0
838	C	37–48+	.037	1

*Presumably Gibbsite.

Congo Soil Profile No. 40

U. S. GOVERNMENT PRINTING OFFICE 16—46512-2

Congo Soil Profile No. 40

Sample No.	Horizon	Depth	pH	Organic Matter	Very coarse sand 2-1	Coarse sand 1-0.5	Medium sand 0.5-0.25	Fine sand 0.25-0.1	Very fine sand 0.1-0.05	Silt 0.05-0.002	Clay <0.002	Organic Carbon*
		cm.										
4884	A1	0-5	5.8	4.5	2.8	6.2	8.1	15.5	8.8	15.1	45.3	
885	A3	5-11	4.9	1.8	2.0	4.3	4.3	13.0	4.1	12.0	28.8	
886	B1	11-17	5.2	1.4	2.0	4.2	4.3	7.7	3.2	9.1	18.3	
887	B2	17-27	5.6	0.7	1.8	2.7	4.8	3.6	0.4	11.6	64.1	
888	C	27-48+	5.6	0.5	1.0	1.0	2.1	2.2	0.3	10.0	82.8	

Profile described by [illegible]

Some Class and Diameter of Particles (in mm.)

Other Classes (in mm.)

Pct.	>2	Pct.	2-0.05	Pct.	<0.05
0		10.6		43.3	
0		8.4		25.1	
0		7.3		17.5	
0		8.3		8.7	
0		7.1		5.3	

Thermal Analysis Data

Particle Size Distribution-Undried

Analyzed into orders*

Sum of Fractions	%	Saturation
H me/100 g		
28.6	62	
15.3	33	
12.5	27	
10.0	22	
9.3	20	

Exchangeable Cations me/100 g

Ca	Mg	K	Na
15.9	11.5	8.8	6.5
5.9	0.9	0.1	<0.1
0.6	0.5	0.1	<0.1
0.5	0.5	0.1	<0.1
0.5	0.5	0.1	<0.1

Total Available

P	K
ppm.	
0	1
0	0
0	0
0	0
0	0

Lbs.	Pct.
1760.	
5760.	0.29
5760.	0.29
5760.	0.29
5760.	0.29

E-8-2047—0 STATE PRINTING DEPARTMENT, C. O.

Almost immediately after lunch we go back into the field on the east side of Kaniama. I look at a soil on a very gently undulating plain with mixed savanna and trees.

A_1	0 - 4½"	Dark grayish-brown clay loam; crumbles to coarse granular which is fairly easily friable to fine granular.
A_{30}	4½ - 7½"	Dark reddish-brown, similar to the above.
A_{31}	7½ - 14"	Brownish-pink to brownish-red clay loam; structure like A_1.
B_1	14 - 26"	Pinkish-red easily friable sandy clay.
B_2	26 - 70"	Yellowish-red slightly compact but easily friable fine sandy clay.
C	70 - 80" plus	Like the above, but somewhat darker; soft fine granular.

Most of the roots are in the A, but a few go to 70 inches. There are vertical cracks in the soil to 40 inches.

This looks to me like a very good soil. M. Jurion thinks it is too light in texture and not firm enough for perennial crops, although he believes it would be suitable for annual crops in rotation with forest trees. Likely he is thinking of the experience at Yangambi.

I suspect this soil is developed from mixed parent material -- perhaps on an old terrace -- although I am not sure that it isn't residual from a fine-grained rock that is neither very acid nor very basic. I am convinced that this whole area was once forested and then intensely cultivated

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by natives. But for a long time now there have been few natives. This gives one to think: Did the natives die out from sleeping sickness? Or did the soils fail and the natives migrate?

I look at another soil in a slight depression in this same plain.

A_1	0 - 5"	Dark gray sandy clay loam; easily friable. Here there are some pink sand grains that suggest some influence of the Kalahara sandstone.
A_{30}	5 - 14"	Brown sandy clay loam; easily friable.
B_1	14 - 24"	Yellowish-brown sandy clay; somewhat compact but friable.
B_{20}	24 - 34"	Brownish-yellow sandy clay; firm, but friable.
B_{21}	34 - 55"	Dull yellow sandy clay; firm, but easily friable. The soil contains some small firm rounded lumps of the same color.
C	55 - 80" plus	Yellow sandy clay; slightly compact, but easily friable. There are very few roots below 18 inches. In the upper part there are a few small vertical cracks. This soil is now being reforested.

I doubt that the material here is residual. It seems to me to have been reworked by water in fairly recent geological times. I suspect this because of (1) the absence of stone lines or quartz pebbles, (2) the absence of lateritic concretions, (3) the very shallow trenching of the adjacent streams, and (4) the pink sand in the surface.

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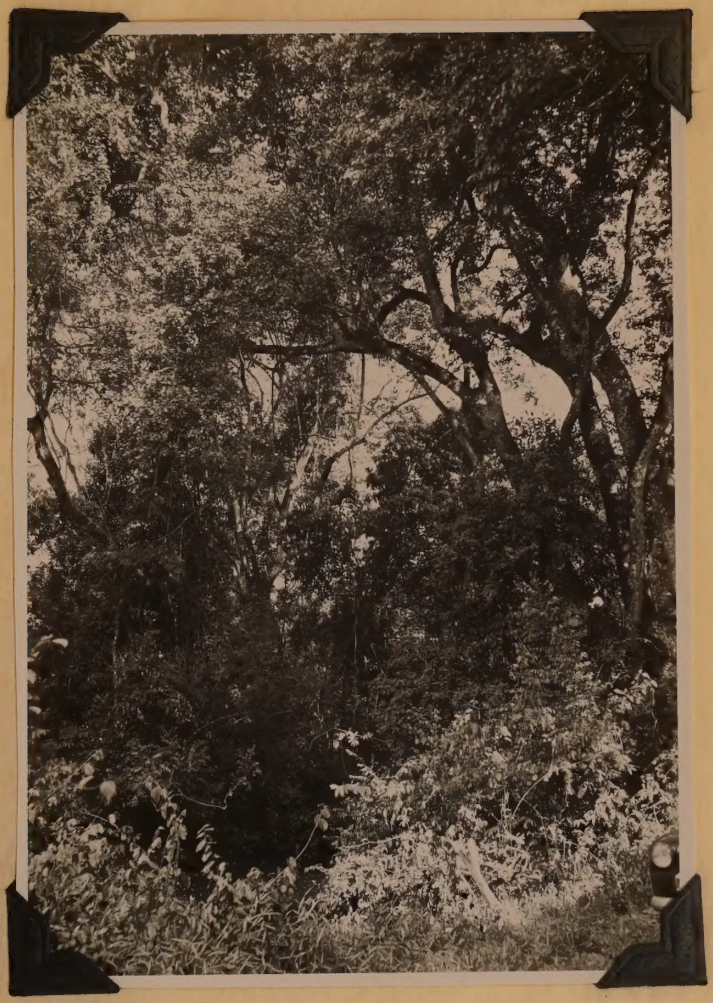
P-LXXI



K-1431 June 27, 1947
Belgian Congo. Near Kaniama. View in gallery forest. Trees are: Khayo nyassica, Rauwolfia, and Vitex.

P-LXXI

K-1431 June 27, 1947
Belgian Congo. Near Kamiama. View in gallery forest. Trees are: Khayo nyassica, Rauwolfia, and Vitex.

The yellow soil described above is in a slight depression and possibly could be regarded as a sort of hydromorphic associate of the red one first described after lunch. Yet I really believe there is more difference than simply a difference in elevation and drainage.

Across a ravine I see another profile of the same red soil. At a slightly higher spot some lateritic hardpan has been observed.

I look at another profile in the gallery forest on a slope of about 1 to 2 percent.

A_1	0 - 6"	Medium-gray clay; coarse granular; friable with difficulty.
A_3	6 - 16"	Mottled light and dark yellowish-brown and gray clay; hard in place and digs out in hard irregular nut.
B_1	16 - 43"	Yellow sandy clay mottled with orange-red and brown and, in the lower part, with black; many concretions.
B_2	43 - 55" plus	Semi-indurated mixture of yellow sandy clay and reddish-brown and black concretions; very close to hard laterite. A few roots just into the B_2, but most are in the A. This soil is a young stage of the last one described at Elisabethville.

On a higher spot I see a soil like the first red one after lunch in all essential surface features of the solum, but with about one-half of the mass made up of concretions from 1/8 to 1/2 inch in diameter below 40 inches. This, in

The yellow soil described above is in a slight depression and possibly could be regarded as a sort of hydromorphic associate of the red one first described after lunch. Yet I really believe there is more difference than simply a difference in elevation and drainage.

Across a ravine I see another profile of the same red soil. At a slightly higher spot some lateritic hardpan has been observed.

I look at another profile in the gallery forest on a slope of about 1 to 2 percent.

A_1	0 - 6"	Medium-gray clay; coarse granular; friable with difficulty.
A_3	6 - 16"	Mottled light and dark yellowish-brown and gray clay; hard in place and digs out in hard irregular nut.
B_1	16 - 43"	Yellow sandy clay mottled with orange-red and brown and, in the lower part, with black; many concretions.
B_2	43 - 55" plus	Semi-indurated mixture of yellow sandy clay and reddish-brown and black concretions; very close to hard laterite. A few roots just into the B_2, but most are in the A. This soil is a young stage of the last one described at Elisabethville.

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my judgment, is a somewhat older part of the plain. There is a gallery forest between this soil and the first two looked at after lunch. I am told that levels show this place to be slightly higher than the first place observed. I suspect this plain may have been eroded and again refilled over a long geological period by a series of shifting fans and terraces.

I drive through an 11-year old forest planted in the savanna. The planting started outward from the intersection of two gallery forests so that it was only necessary to build a fire line along one side of the rough triangle. The trees now are 6 to 10 inches d.b.h. There are a great many vines. Now the gallery trees are spreading into the planting from the galleries. Such a forest is no longer likely to burn.

In starting the reforestation in the savanna, a planting is made of a shrubby fiber plant called Triumfetta cordifolia, along with timber trees from the nurseries and other light, faster-growing trees. The shrubs are planted from seed in rows 3 meters apart and 1 meter apart in the row. The trees are planted 3 meters by 3 meters. Four species are used in the mixture. The best one is Chlorophora excelsa. Only indigenous species are used.

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All savanna grasses have disappeared by that time, including the trees normally found in the savanna. That is, the savanna trees cannot endure the shade of the forest.

Of course, it is necessary to protect these plantings from fire for the first few years. Now the forest people are doing quite a bit of burning at the very beginning of the dry season in order to avoid later fires which are much more serious in killing the young shrubs and trees. That is, if the savanna is going to burn anyway, it is very much better that it burn early. But, of course, it would be very much better yet if it were not burned at all.

This work is financed by the Comitè Special du Katanga. At this place they have been reforesting about 50 hectares per year and now have 500 hectares planted. The work is not very expensive. They have been able to replant one hectare per year for each native worker.

This work looks very good to me indeed. Once these areas are reforested and the hazard of fire is removed, it will be entirely possible to have forest-crop rotations on the better soils within the new forests.

I have to leave the field because it is no longer light enough to see or write.

We go back out to the soil survey camp for dinner and return to the home of M. Herman for the night. What a day!! I am not only very tired, but have a badly upset digestion.

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June 28: Kaniama to Luluabourg

Up early after a very bad night with a digestive upset. I am afraid I got too hot and tired just before the heavy lunch yesterday.

We leave at 7:30 a.m. on a very gently undulating plain with red, brown, and reddish-brown soils. The cover is mostly savanna and scattered trees with some gallery forest. All the galleries here are not in old stream channels although most of them are. At eight miles the soil is mostly gently rolling, dark brown with red underneath. I can see several outcrops of lateritic hardpan along the road. Within the rolling areas are a few undulating places of considerable size. There are only a relatively few small termite mounds. Some tobacco is grown here along with a cover crop of Mimosa invisa. I see a few patches of cotton about to be harvested and ripe maize. There are some oil palm groves. This general region has only a small native population. Hence, the present interest in European settlement.

We pass Lupata -- a large native village. The soil is a deep red. Here there is quite a bit of native oil palm along with cotton, maize, and cassava.

At 8:50 we come to the Lubilash River and wait for the native ferry. This is built on three small steel boats and is propelled by natives with bamboo poles. The river has a

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At 8:50 we come to the Lubilash River and wait for the native ferry. This is built on three small steel boats and is propelled by natives with bamboo poles. The river has a

rather high broad first bottom mostly covered with tall savanna. Beyond, is gently rolling and undulating red soil with lateritic hardpan, in places at least. The cover is nearly open savanna with a few trees, especially Borossus palm. To the south there is slightly higher land with a hilly escarpment facing us. I see only a few remnants of narrow forest galleries. There are very few villages, but some patches of cassava, cotton, and oil palm are seen.

We pass Lusuku. Here there is a gently rolling reddish-brown and red soil with concretions and lateritic hardpan in places. A little farther west there are more trees in the savanna and somewhat bigger gallery forests. The land becomes undulating for the most part, and there are more natives.

About 10 o'clock we pass Luputa, a considerable trading center and large native village, where we stop for gasoline.

North of here, at Gandajika, INÉAC has a cotton station with somewhat similar soils, according to Director Jurion. He says they are lighter in color and contain more coarse sand than the ones we have seen this morning. They are probably like the orange-red soils from granite that we saw yesterday.

West of Luputa is undulating reddish-brown soil with considerable sand and some concretions. The savanna has only scattered trees and very thin galleries. About 10 kilometers

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This is the area of the Baluba tribe, said to be an important one. We ferry the Luilu River which has a wide stream bottom, perhaps a mile and a half across. This area produces food crops, especially cassava, and maize for the Katanga Mines.

West of the river there is undulating reddish-brown and grayish-brown somewhat sandy soil. The cover is mainly savanna but there are patches of cotton and cassava and a few thin forest galleries.

A little east of Mwene Ditu we come on to a gently rolling soil -- grayish-brown over yellowish-red -- from granite along with some red soil with concretions. Here there is more gallery forest and the country is fairly well populated. I see a few European farms. There is considerable cassava and maize and some bananas. Beyond this town the soil is undulating, dark brown and rather sandy. To the west of the town there is some strong dissection. This undulating to rolling relatively sandy area of brown soil extends many miles to the west. Most of it is fairly open savanna with some gallery forest. A relatively small part is used for cotton, cassava, and other food crops.

We cross the Bushimaie River about noon. Just east the soils of the uplands and terraces are somewhat heavier. A

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This is the area of the Balunda tribe, said to be an important one. We ferry the Lulua River which has a wide stream bottom, perhaps a mile and a half across. This area produces food crops, especially cassava, and maize for the Katanga Mines.

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mile west of the river we are back on the relatively sandy brown soil with patches of red soil. There is a good deal of cassava and some maize and cotton. Here there is still some gallery forest. Until recently there was quite a bit of other upland forest but this has been badly cut by the natives.

Most natives here wear both lower and upper garments except for small children and for part of the women.

We go west of Jujule on rolling grayish-brown and reddish-brown sandy soil with rather large gallery forests. The lower slopes here often have heavier soil. It is now very hot and dry.

After about 10 miles I see some outcrops of granite and a few of lateritic hardpan. For many miles the soil is mostly undulating and grayish-brown.

We pass Kalwata. Here there is gray rolling sandy soil quite well populated. There are a few trees and shrubs in the savanna, but only fair galleries. There is a good deal of cassava. It doesn't grow on these sandy soils as well as it does on the better soils, but apparently it does much better than alternative food crops.

A few miles east of Dumba the soil changes from gray to reddish-brown, but is still sandy.

People wear less and less as we go west, especially the women. We pass Batanda at three o'clock. For a long distance

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here I see undulating and rolling reddish-brown sandy loam. The cover is mostly savanna with scattered trees, especially palms. The heavy population of natives has practically destroyed the forest. A few miles beyond, I get a picture of a medicine man of the Bena-Lulua tribe.

Because of its special problems and the heavy population, INEAC plans to establish a new experiment station in this region.

We continue on toward Luluabourg with here and there a few spots of heavy red soil noticeable in the lowest road cuts. Beyond Kalumba the vegetation becomes somewhat more vigorous. Some bananas are grown. I notice a few flowering shrubs in the native villages. Along the Lubiampata River we pass a broad sandy alluvial terrace. Near Luluabourg the soils appear to be mostly reddish-brown loams and sandy loams.

We reach Luluabourg about five o'clock and have excellent quarters for the night. My stomach is still much upset, so I have a light dinner and go to bed early.

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June 29: Luluabourg to Leopoldville

After a good night's sleep I feel somewhat better and take a walk around the village of Luluabourg. At 10:45 we drive out to the airport in a little bus with no springs. I am afraid that again we have too much baggage; but Director Jurion assures me that everything will be o.k. (But we do pay the excess baggage!) The plane comes in a little late from Elisabethville. It is a two-engined 21-passenger Lockheed. We are in the air at 12:30 p.m.

From the air one sees more fields around Luluabourg than from the road because the roads are on the divides and most of the fields are on the lower slopes of the valleys near the margins of the galleries. The country is rolling to strongly rolling with undulating plateaus on the divides. Although this region was once all covered with forest, trees remain only in the galleries along the streams and in a few of the coves.

Density of population and of fields reduces sharply about 15 to 20 miles out. The pattern of streams and forests is quite irregular -- much less so than any of the maps of this region suggest. The streams are anything but straight. As we go on west, I see very few signs of people.

At about 60 miles west of Luluabourg forest is the dominant vegetation. Near Mutombo the cover is over one-half

June 29: Lulaboura to Leopoldville

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At about 60 miles west of Lulaboura forest is the dominant vegetation. Near Mutombo the cover is over one-half

forest, but this is thin on the higher slopes. Near the rivers the cover is about 75 to 90 percent forest.

We pass Charlesville on the Kasai River. Here there are docks and railway yards and some industrial plants.

On the way west to the Loange River I see considerable active dissection -- natural erosion -- and muddy streams. About one-fourth of the land is in forest galleries. The plateaus between are extremely sandy and the cover almost pure savanna. Only where the dissection is quite deep -- deep enough to uncover lower beds of materials rich in clay -- is there forest. I see very few habitations.

The Loange River is a muddy stream with many sand bars and ox-bow lakes. West of the river is a broad forest-covered flood plain. Beyond is an irregular pattern of forest and savanna. Here also the heavy forest is below the escarpments-- below the waterfalls of the streams -- where the sandstone (Kalahara) has been cut and eroded away.

Near Dumba are some villages. West of Dumba the land is strongly dissected, apparently very sandy (?), and mostly savanna. But I see a few villages here and there.

The air has now become so hazy and my map is so very bad that it is difficult to locate myself above the terrain.

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galleries and nearly pure savanna. This continues for some distance. Again between the Gobari and the Lukulu rivers are many roads and native villages. We pass the time belt and set our watches back one hour. We fly over clouds all the rest of the way to Leopoldville with only occasional glimpses of the land. Director Jurion explains that this area had a heavy population long years ago. Apparently they were largely destroyed by sleeping sickness sometime before European occupation.

We are down at Leopoldville at 2:45 p.m. A large crowd is waiting here to see the Prince Regent. He is scheduled to arrive at the airfield from Brussels at 4 p.m. We go to the city in a little bus which has quite a time getting to our hotel because a parade is assembling of military formations, school children, etc. for the Prince Regent.

As I go to my room in the hotel, I get the first letters from the United States since leaving Yangambi. This makes one feel that he is in a more nearly normal environment.

It is cloudy, hazy, and warm here. The sky suggests rain in the next few moments, but it will not rain because this is not the proper season for it. From my room in the Palace Hotel I look across the broad Congo River to Brazzaville in French Territory. Here the river is very wide.

To bed early.

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June 30: In Leopoldville[a]

This is a holiday, partly because of the visit of the Prince Regent. I had only a few letters yesterday so I go to the post office but there is no more mail. Apparently most of my mail has been lost. Then I go down to the airfield to see about my return ticket to Brussels. Since I shall be returning to Brussels from Leopoldville instead of Stanleyville, the tickets will need to be changed.

I stop to visit the American Consul -- Mr. Guynn. He talks so openly and critically about his minor difficulties of living in Leopoldville that I am much embarrassed since Director Jurion is with me. He invites Director Jurion and me to his home for dinner tonight. I don't know just how it will go. I make arrangements at the Consulate for bringing in my field equipment next week and having it shipped by freight to Washington.

I walk around the city, but most places are closed because of the holiday.

After lunch I take a short drive in the suburbs of Leopoldville out along the Congo River to get pictures of the rapids. The river is navigable upstream all the way to Stanleyville, but it is not navigable below Leopoldville except for the short distance between Matadi and the Atlantic.

We come back into the city just in time to see the Prince

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[a] Elevation about 1,050 feet and annual rainfall about 50 inches.

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K-1432 June 30, 1947
Belgian Congo. Rapids of Congo River just below Leopoldville.

K-1433 June 30, 1947
Belgian Congo. Prince Regent in Leopoldville.

15-11

K-1432 June 30, 1917
Belgian Congo. Rapids of Congo River
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15-12

K-1433 June 30, 1917
Belgian Congo. Prince Regent in Leopoldville.

Regent and his entourage turn up the street ahead of us. We follow along and get out to watch the proceedings as he makes the usual formal salutes at the War Memorial.

I take some maps to the American Consulate to have sent back to the United States by air. I am told that mail which came for me here has been sent to my hotel. But now, three hours later, it hasn't arrived.

From about 2:30 to 3:15 I have a conference with M. Pierre Wigmy, Minister of Colonies, who is also visiting the Congo. He asks about my report and I explain that I usually prepare a detailed journal but that I have no additional special report in mind. Among several topics discussed are these: (1) The pressing importance of additional measures to control soil erosion in Ruanda, especially near Astrida. I emphasize that the Belgian agricultural technicians know perfectly well what to do, but that they need more cooperation from the administrative people in the development of an effective program for reducing cattle numbers. Most of the administrators insist that this is a difficult problem. That is true. But they shouldn't be allowed to sidestep it for that reason because unless the cattle numbers are reduced by an orderly administrative program, they will be reduced by starvation. And in the process many hectares of good pasture land will be seriously damaged by erosion.

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(2) We discuss the serious erosion in the Albert National Park and the need for reducing the numbers of hippopotami. The principle involved here is exactly the same as at Astrida.

(3) I emphasize the extreme importance of having proper aerial photographs available for soil survey work and for other investigations of INÉAC. I outline our experience in the United States and point out that with aerial photographs the work can be done so much more accurately that it is entirely economic to spend a great deal for them. The Minister thinks that arrangements can be made with the military to have the pictures made, bearing in mind the needs of INÉAC.

(4) I raise the question of the desirability and possibility of an international research institute and graduate school in tropical agriculture in which all important countries with an interest in the tropics might contribute. The Minister assures me that his government would be very sympathetic to such a proposition and anxious to take its appropriate share of responsibility for it.

Although the Minister is new in this position, and although this is his first visit to the Congo, I am well impressed with him. He is obviously a man of learning and culture and I believe he has a deep interest in doing his honest best to develop the country in ways that will advance

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(3) I emphasize the extreme importance of having proper aerial photographs available for soil survey work and for other investigations of INEAC. I outline our experience in the United States and point out that with aerial photographs the work can be done so much more accurately that it is entirely economic to spend a great deal for them. The Minister thinks that arrangements can be made with the military to have the pictures made, bearing in mind the needs of INEAC.

(4) I raise the question of the desirability and possibility of an international research institute and graduate school in tropical agriculture in which all important countries with an interest in the tropics might contribute. The Minister assures me that his government would be very sympathetic to such a proposition and anxious to take its appropriate share of responsibility for it.

Although the Minister is new in this position, and although this is his first visit to the Congo, I am well impressed with him. He is obviously a man of learning and culture and I believe he has a deep interest in doing his honest best to develop the country in ways that will advance

the native population as well as the European residents.

In the evening Director Jurion and I are guests for supper at the home of the American Consul General -- Mr. and Mrs. Guynn. It is a pleasant evening. In conversation with Director Jurion and a Mr. Anderson, who has long been a teacher-missionary in the Mission School near Luluabourg, I gather that natives are moving to the large cities in the Congo much too rapidly. They tell me that in Leopoldville there are large numbers of unemployed natives supported by other members of the clan. Mr. Anderson thinks this going to the city is partly in order to escape work on roads, government buildings, etc. But Director Jurion does not feel that this is the most important factor since natives are generally paid for such work. He feels, on the other hand, that the movement is due to the familiar pull of the "city lights", especially at the urging of the women folk, who need to do so much of the field work when they live in the country, but who have little to do when the family lives in the city.

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L'AVENIR COLONIAL BELGE
Leopoldville, Belgian Congo,
June 24, 1947.

Le directeur général de l'Inéac à Elisabethville

Samedi, sont arrivés à Elisabethville M. Jurion, directeur général de l'Inéac et le docteur Kellogg, chef du bureau d'étude du sol "Soil Survey" du département de l'Agriculture des Etats-Unis.

M. Kellogg a assisté récemment au Congrès de Montpellier, consacré au rétablissement des relations internationales pour l'étude des sols.

C'est sur l'invitation de l'Inéac et du Gouvernement Belge qu'il est venu au Congo. Arrivé à Stanleyville, le 2 juin, il a visité le laboratoire de pédologie de Yangambi. Il a parcouru rapidement les Uélés, l'Ituri et le Parc Albert.

Il a traversé le Ruanda-Urundi et la plaine de la Ruzizi. Il s'est arrêté à la station de recherches de Mulungu.

Après son séjour au Katanga, il visitera la mission de pédobotanique de l'Inéac, dans Loami près de Kaniama, et repartira ensuite pour le Bas-Congo.

L'AVENIR COLONIAL BELGE
Leopoldville, Belgian Congo.
June 24, 1947.

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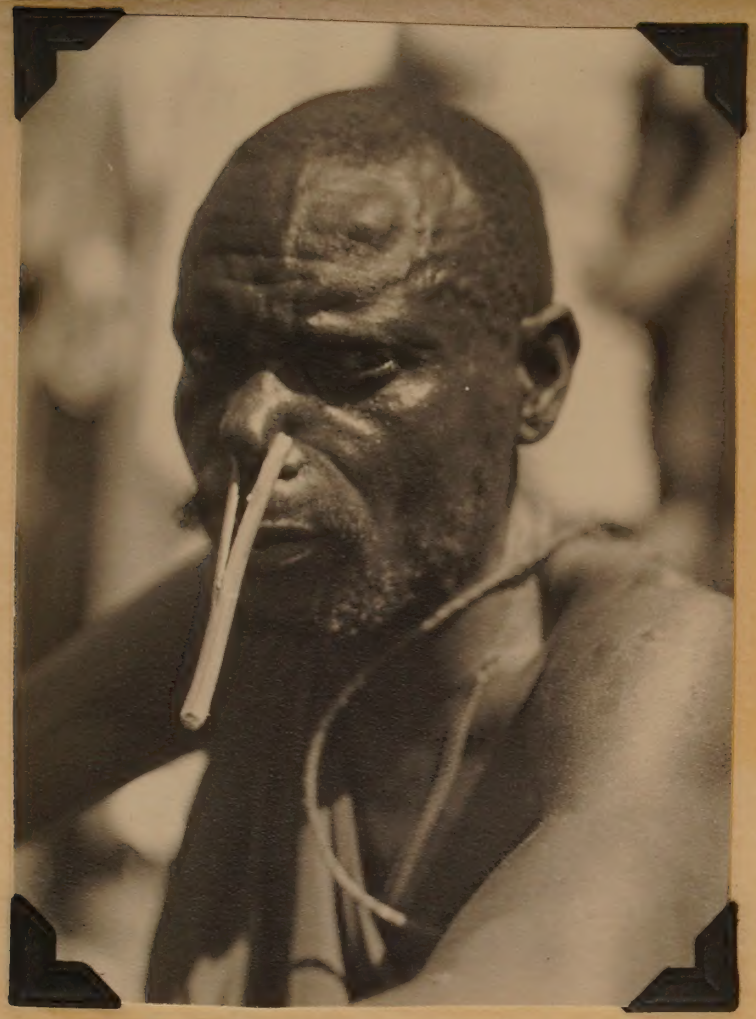


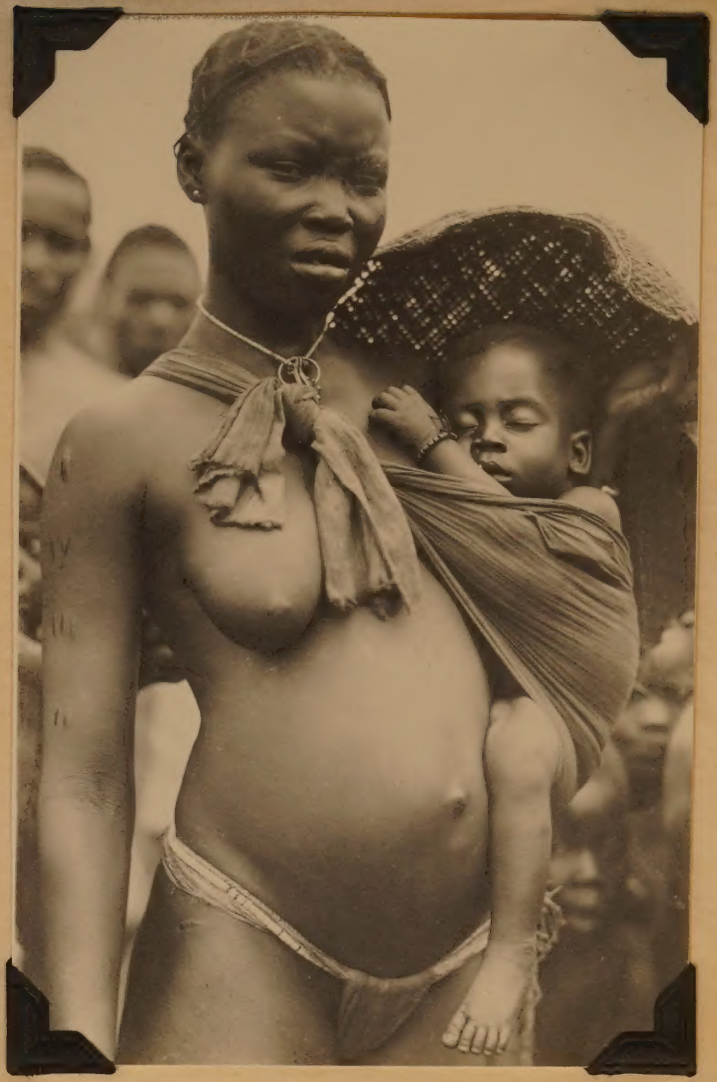
A native wears such a stick after taking snuff. (Commercial photo)

A family group. (Commercial photo)

Б-IXXII V

А типичный вход. (Commercial photo)

Двор типичного старого дома в центре города. (Commercial photo)



Characteristic native women. (Commercial photos)

P-IXXII B

Adolph Reichmann (Commerzrat Bruno) Neuwied a/Rh. Christstrasse

Characteristic native women. (Commercial photos)

P-LXXII C

P-IXXII C

Quaestaertste vsrtve mowev. (Commercial photos)

July 1: Leopoldville and Brazzaville

I get up this morning with a very bad digestion again! After breakfast I meet M. C. Donis, Director of INEAC's Forest Experiment Station at Luki in the Low Congo, who is to be my companion next week since Director Jurion must, unfortunately, return to Stanleyville in order to meet his distinguished guests of the near future -- the Minister of Colonies and the Prince Regent.

Most of the morning I rest my sick stomach and then M. Donis and I take a little motor launch across the Congo River to Brazzaville -- the capital of French Equatorial Africa. This city is quite a bit smaller than Leopoldville. It is spread out a good deal, especially along the river. We tour the city in little one-wheeled carts. Each cart has a native behind to push and one in front to pull. We spend perhaps an hour or more going about the city and then I return to my hotel in Leopoldville. I am very glad to be back. One always wonders whether he has one of these mysterious tropical diseases. Anyway, I start on the supply of sulpha drugs that I brought with me which have been heretofore unopened.

After a long rest in bed I feel a little better and take a short walk. Then I have a conference with the executives of the Leopoldville Radio Station and promise to give

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K-1528 July 1, 1947
French Equatorial Africa. Brazzaville.
The traveler takes a holiday.

them an interview on my return from the Low Congo.

In the evening we go out to another hotel for dinner and I buy some little ivory elephants. One of the agricultural advisory people from Usumbura brings me a large piece of the native cloth used in Urundi, which is made from the bark of a tree, and also a very nice finely and delicately woven little jewel basket made by a native in Ruanda.

Upon returning to my room I find that a reception for the Prince Regent is in full swing at my hotel. This is a lot of racket for going to bed.

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July 2: Leopoldville to M'vuazi/a

M. Donis and I are up very early. After breakfast I say my goodbyes to Director Jurion with great regret. We leave on the train from Leopoldville at 7 o'clock.

We start out on sandy loams and sands along the low terraces of the Congo and gradually work into more dissected country with yellow and reddish-yellow soil. The original forest has been largely destroyed and now the ground cover is savanna with patches of shrubs and young trees. Fields of food crops include cassava and bananas as well as some oil palm and small patches of nitrogen-starved sugar cane.

At Sona Bata the soil is reddish-yellow in the upper part and pinkish-red in the lower part. I see some lateritic hardpan in the cuts along the railroad. The ground cover is mostly savanna with a few scattered trees, a few trees in clumps, and some forest galleries. The soils here have been badly overcropped by the natives. This area was undoubtedly forest at one time but has supported a heavy population since the Stone Age.

At Marchal there is a large market for natives to sell cassava and other food crops which are shipped to Leopoldville. Most of the soil here is yellow with a lateritic

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/a The elevation is about 1,550 feet, and the rainfall approximately 51 inches.

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K-1444 July 2, 1947
Belgian Congo. Marchal. Market from train.
Selling cassava and other crops.

K-1529 July 2, 1947
Belgian Congo. M'Vuazi. Profile yellow
lateritic soil (like sample No. 4).

K-1444

16-1

K-1444 July 2, 1947
Belgian Congo. Marchal. Market from train.
Selling cassava and other crops.

K-1529

K-1529 July 2, 1947
Belgian Congo. M'Vuazi. Profile yellow
lateritic soil (like sample No. 44).

hardpan. There are a few high undulating terraces. Most of the land is gently to strongly rolling and relatively poor now for food crops because of overcropping.

Beyond Marchal we climb into higher hills -- the highest part of the railway route to Matadi. The rocks are dominantly calcareous (dolomitic) schist. The cover on these hills is mostly quite open savanna with food crops on the margins of the galleries, which here are very thin and nearly gone.

We leave the train at Dethieu about 11:30 and are met by M. R. Van Laere, Director of INÉAC's fruit station at M'vuazi. He drives us out to the station in a Ford pickup and we have lunch with the Director and his wife.

Immediately after lunch we go out to look at the soils and the experimental work.

We stop first on the upland to look at a representative soil. The land is strongly rolling to hilly. Where the profile is made the slope is about 10 percent. Perhaps thousands of years ago the land was forested, but now it has savanna with scattered shrubs and trees. This is a yellow lateritic soil.

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Soil Profile Sample No. 41

$A_{1 + P}$	0 - 7½"	Dark gray clay, somewhat coarsely prismatic; digs out in clods that are easily broken to hard irregular rounded nut, friable under very hard pressure. (Grayish-brown when dry)
A_{30}	7½ - 10½"	Dark gray clay mottled with yellowish-brown. (Brown when dry)
A_{31}	10½ - 16½"	Mottled, dark yellowish- and grayish-brown and light yellowish-brown, heavy friable clay; numerous small rounded dark red semi-indurated concretions. (Brown, brownish-yellow and yellowish-brown when dry)
B_1	16½ - 27"	Yellowish-brown friable gravelly (concretionary) clay, mottled with yellow. The soil falls into friable subangular nut; concretions are rounded and flattened and dark red in color. (Brown to brownish-yellow when dry)
B_2	27 - 43"	Like the above, but slightly lighter in color. There are more and larger concretions and a few fragments of light gray partially weathered siliceous schist. (Yellow to brownish-yellow when dry)
C	43 - 60" plus	Dark yellow or orange-yellow clay with a high percentage of fairly hard somewhat flattened dark red concretions. (Reddish-yellow when dry)

The roots are mostly in A, but some go to 60 inches. Where exposed in road cuts, the B becomes harder but not indurated into a lateritic hardpan. I see a few hard rounded boulders of siliceous schist.

In a small forest reserve I see a similar soil with orange-red in the C rather than yellow and small fragments

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Table 14. Mechanical analyses of Yellow Latosol. (41)

Sample No.	Horizon	Depth	pH	Organic Matter by H_2O_2	Size Class and Diameter of Particles (*in mm.*)							Other Classes (*in mm.*)		
					Very course sand 2–1	Coarse sand, 1–0.5	Medium sand, 0.5–0.25	Fine sand, 0.25–0.1	Very fine sand, 0.1–0.05	Silt, 0.05–0.002	Clay, <0.002	0.02–0.002	<0.005	>2
		Inches		*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
471637	$A_{1+(p)}$	0–7½	4.0	4.4	2.4	5.4	1.4	3.5	7.9	31.8	47.6	19.7	52.7	0
38	A_{30}	7½–10½	4.2	3.2	1.6	2.8	2.7	7.7	7.2	29.9	48.1	17.8	53.3	0
39	A_{31}	10½–16½	4.3	2.6	1.2	2.5	1.7	5.2	7.9	27.4	54.1	17.1	58.8	10
40	B_1	16½–27	4.4	1.8	4.0	2.5	1.5	4.1	5.9	25.6	56.4	14.7	59.9	53
41	B_2	27–43	4.4	1.3	1.6	1.8	1.2	3.9	4.6	24.4	62.5	15.2	66.9	67
42	C	43–60	4.7	0.5	2.4	2.5	1.0	2.9	4.0	20.6	66.6	13.3	70.8	42

Congo Soil Profile No. 41

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Congo Soil Profile No. 41

Sample No.	Horizon	Depth	pH	Mineralogical Character	Size Class and Diameter of Particles (in mm.)									
					Very coarse sand, 2–1	Coarse sand, 1–0.5	Medium sand, 0.5–0.25	Fine sand, 0.25–0.1	Very fine sand, 0.1–0.05	Silt, 0.05–0.005	Clay, <0.005	Other Classes (in mm.) 0.05–0.005	<0.005	>2
33	A	0–4	4.4		4.3	2.3	1.0	2.2	0.3	5.0	4.3	12.2	8.0	0.0
34	A_2	4–10	4.4		4.3	1.8	1.2	1.4	0.4	4.5	4.3	12.2	8.0	0.0
35	B_1	10–20	4.4		4.3	1.8	1.2	1.4	0.4	4.5	4.3	12.2	8.0	0.0
36	B_2	20–30	4.4		4.3	1.8	1.2	1.4	0.4	4.5	4.3	12.2	8.0	0.0
37	B_3	30–40	4.4		4.3	1.8	1.2	1.4	0.4	4.5	4.3	12.2	8.0	0.0
38	B_4	40–50	4.4		4.3	1.8	1.2	1.4	0.4	4.5	4.3	12.2	8.0	0.0
39	B_5	50–60	4.4		4.3	1.8	1.2	1.4	0.4	4.5	4.3	12.2	8.0	0.0
40	B_6	60–70	4.4		4.3	1.8	1.2	1.4	0.4	4.5	4.3	12.2	8.0	0.0
41	B_7	70–80	4.4		4.3	1.8	1.2	1.4	0.4	4.5	4.3	12.2	8.0	0.0
42	B_8	80–90	4.4		4.3	1.8	1.2	1.4	0.4	4.5	4.3	12.2	8.0	0.0
43	B_9	90–100	4.4		4.3	1.8	1.2	1.4	0.4	4.5	4.3	12.2	8.0	0.0
44	B_{10}	100–110	4.4		4.3	1.8	1.2	1.4	0.4	4.5	4.3	12.2	8.0	0.0
45	B_{11}	110–120	4.4		4.3	1.8	1.2	1.4	0.4	4.5	4.3	12.2	8.0	0.0
46	B_{12}

of siliceous schist in abundance in B_1 and B_2 instead of the dark red semi-indurated concretions.

I then go to look at the soil on a low imperfectly drained nearly level stream terrace.

A_1	0 - 2"	Very dark brown fine sandy clay loam; rather hard when dry, but normally easily friable to soft fine crumb. Gradually fades to:
A_3	2 - 6"	Brown fine sandy clay loam; firm, but easily friable. Gradually fades to:
B	6 - 20"	Light yellowish-brown fine sandy clay; firm, but easily friable. Gradually fades to:
C	20 - 72" plus	Light yellowish-brown alluvium. A little lighter in texture and color than the above; friable; a few small concretions that have been washed in.

The roots go down to 6 feet. This is a very young soil. At the present time the material in both C and B are used for making bricks.

Citrus and other fruits are grown here, under irrigation, from July to September, while they are little.

Up the small river a little way I see beans growing on land cultivated by native farmers on the sandy loam type of the soil just described. The beans are planted on ridges, or narrow beds, about 2 feet wide at the top. The ditches between these beds are some 15 inches deep and 40 inches apart. In the rotation the beans will be followed by peanuts and these by cassava.

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The uncultivated land has very tall pennisetum grass some 10 to 14 feet high. Of course, this is the best grass for fallow.

While looking at this field I meet an old native carrying the old-style flint-lock rifle. I understand that natives are not permitted modern arms but a great many have old style single-shot rifles as the next best after a spear or a bow-and-arrow.

I now go to look at a very interesting banana planting on practically level alluvial soil where the water table is around 50 to 60 inches. Although the bananas themselves are not irrigated, the water table is kept at this height partly because of water running in the adjacent irrigation channels.

I look at the soil:

(1) 0 - 8"	Grayish-brown fine sandy loam of recent origin through flooding; firm, but friable.
(2) 8 - 17"	Dark gray, very finely mottled with reddish-brown, heavy silty clay. Where I look at the soil there are clear evidences of old pre-historic hearths.
(3) 17 - 21"	Medium-gray silty clay
(4) 21 - 36" plus	Finely mottled gray and brown silty clay

These bananas were planted in 1936, following a long stand of pennisetum. The yield in 1937 was satisfactory at

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15 tons per hectare. In 1938 it dropped to 3 tons and in 1939 the yield dropped essentially to zero. In 1940 the management practice was changed to include the addition of mulch and compost twice a year. Fifty kilos of compost are mixed in the surface foot of soil around the clump. This requires 4 tons of compost per hectare per application. In addition, the land is given 20 tons of mulch, which is simply the green savanna grasses.

After this treatment, the yield in 1941 was 15 tons of bananas per hectare and it has been maintained at 15 tons continuously to the present time with this treatment. Of course, this means that by now the compost has been quite thoroughly mixed with the upper foot of soil around all the banana clumps. However, if the treatment is stopped, the yield goes down at once.

Mineral fertilizers alone will not maintain the yields, but a mixed mineral fertilizer plus the mulch of savanna grasses will give a yield of about 16 tons. But the cost is so very much greater that the practice is not economic.

I go to look at the pits where the compost is made. There are four deep pits, about 15 feet square with heavy concrete walls, made together in a square about 30 feet by 30 feet. Each pit slopes to the center where there is a well into which any liquid may drain. This liquid is pulled

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K-1445 July 2, 1947
Belgian Congo. M'Vuazi. High-yielding bananas (about 15 tons/hectare) given compost and mulched with pennisetum.

16-7

K-1445 July 2, 1947

Belgian Congo. M'Vuazi. High-yielding
bananas (about 15 tons/hectare) given compost
and mulched with pennisetum.

K-1446 July 2, 1947
Belgian Congo. M'Vuazi. Compost pits.
Vegetable matter and cow manure mixed in one pit and turned weekly into one of the other pits successively, and then onto the platform.

16-3

K-1446 July 2, 1947
Belgian Congo. M'Vuazi. Compost pits.
Vegetable matter and cow manure mixed in one
pit and turned weekly into one of the other
pits successively, and then onto the platform.

out in pails and thrown back on to the compost. Then there is a concrete platform 30 feet long and about 12 feet wide along one side.

Two native boys operate this installation continuously. In pit No. 1 a mixture of pennisetum grass, cuttings from legumes, cow manure, banana leaves, etc. are placed and mixed together. At the end of a month this compost material is forked over from pit No. 1 to pit No. 2 and a new batch of material put into pit No. 1. Then the old material goes to No. 3 at the end of another month and to No. 4 at the end of still another month. Finally it goes out on the platform where it is ready to use.

With this arrangement, the two native boys produce about 4 tons of compost per month at a cost of about 80 francs (about 90 cents) per ton.

This compost is also used with citrus every year after the trees are five years old. Fifty kilos of compost are placed in a small pit 3 feet by 20 inches by 3 feet deep about 5 feet from the tree. Each two years a pit is dug in a different position near the tree for this compost.

I look at oranges planted in 1945 and irrigated up until now, but they will not be irrigated any more. The soil here is quite heavy. Where the soil is sandy they will need to be irrigated every year during the dry season. The

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K-1447 July 2, 1947
Belgian Congo. M'Vuazi. Oranges planted in 1945, irrigated until now but will not be irrigated more. Trees 6 m. in row and rows 8 m. apart. Companion plant is Flemingia congensis -- a deep-rooted woody legume.

16-4

K-1447 July 2, 1947

Belgian Congo. M'Vuazi. Orange planted in 1915, irrigated until now but will not be irrigated more. Trees 6 m. in row and rows 8 m. apart. Companion plant is Flemingia congensis -- a deep-rooted woody legume.

trees are 6 meters apart in the row and there are 8 meters between rows.

I am particularly interested in the hedges of companion crop grown with the citrus. This is a leguminous shrub called Flemingia congensis, a very deep-rooted plant. This is seeded with Crotalaria at the same time the trees are planted. The Flemingia is likely to germinate somewhat unevenly and requires careful weeding the first year. After being established the plants are cut back with a machete every two months so that one has four hedges of this legume between each pair of citrus rows. This system gives the best results. Certainly the trees look very fine. They are using also Pueraria, similar to our kudzu, but these plants seem to compete more for nutrients with the orange tree roots and the leaves are likely to turn yellow.

I see some nice four-year old lemon trees growing with this leguminous shrub as a companion crop. These trees bear continuously. I should suspect that the fruits are too large for commercial use since many of them are up to 4 inches in diameter and weigh around 12 ounces apiece.

I also see some excellent mandarins bearing the best tasting citrus I have ever had.

We go back to the little guest house and change for dinner. The dinner is excellent. Possibly my digestion is

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back to normal again.

We walk back to the guest house in the light of a beautiful tropical moon. We hear in the distance the beat of the tom-toms. I am told that the natives always dance to the tom-toms on nights with a good tropical moon.

July 3: At M'Vuazi Station and to Matadi[a]

This morning there is a heavy mist. It is interesting that during the dry season in the Low Congo the humidity remains very high -- considerably higher than during fair days in the rainy season.

Immediately after breakfast I visit the tree nursery. About 10,000 trees, mostly citrus, are sent from this station annually. Europeans pay 25 francs per tree plus carriage. The natives are given trees. There are still very few citrus plantations in the Congo and most of the trees are put in home gardens. I see some of the grafted trees ready for shipment and they look nice. They are packed in large boxes filled with soil and can be three months in transit if kept watered. The natives have been trained to do the grafting. Each one makes about 150 grafts per day, of which about 95 percent are successful.

The nursery is located on dark brown irrigated alluvial soil. The young trees are kept well mulched.

On the station the citrus trees are sprayed three times per year -- once with copper and twice with oil.

I look at some experiments with different stocks as base for scions. Unber -- a sour mandarin from South Africa-- seems to be the best for lemons. A rough lemon stock from South Africa seems to be the best for oranges, mandarins, and grapefruit. All the experimental trees are measured

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[a] Elevation about 285 feet and annual rainfall about 40 inches.

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K-1448 July 3, 1947 Belgian Congo.
M'Vauzi. Washington navel oranges planted in November 1938. Large trees were grafted on rough lemon stock, the small ones on bigaradier -- a sour orange from the Mediterranean region. Pennisetum grass at left; pueraria ground cover; and Ceiba pentandra (kapok) tree in background.

K-1449 July 3, 1947
Belgian Congo. M'Vuazi. Base of mandarin tree showing how roots of citrus are exposed to sunlight to avoid gum disease.

K-1449 July 3, 1947 Belgian Congo.
M'Vuazi. Washington navel orange planted in
November 1938. Large trees were grafted on rough
lemon stock, the small ones on bigaradier -- a sour
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grass at left; pueraria ground cover; and Ceiba
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K-1449 July 3, 1947
Belgian Congo. M'Vuazi. Base of mandarin tree showing
how roots of citrus are exposed to sunlight to avoid
gum disease.

K-1450 July 3, 1947
Belgian Congo. M'Vuazi. Another group of compost pits. M. R. Van Laere, Director of station, at right.

K-1530 July 3, 1947
Belgian Congo. M'Vuazi. Montana tung with ground cover of pueraria.

K-1250 July 3, 1947
Belgian Congo. M'Vuazi. Another group of composite
pits. M. R. Van Lacre, Director of station, at
right.

K-1530 July 3, 1947
Belgian Congo. M'Vuazi. Mortsas tung with ground
cover of pueraria.

twice each year. Two sets of workers make alternate measurements.

Here the citrus must be planted shallow with the main roots at the very surface, even slightly exposed, else they are destroyed by the gum disease. They have considerable trouble here with the grapefruit because the soil is too heavy. Any areas affected with the gum disease are cleaned and treated with potassium permanganate at 1 to 100. The big roots are exposed and these and the tree are brushed with copper and white-washed with good results.

Here they combat "muscle" scale and "woolly" scale on little citrus trees by brushing the stems and old leaves with a solution of nicotine, cotton seed oil or peanut oil, and oleic acid.

In the heavy soils the trees are planted in raised beds about 18 inches higher than the irrigation ditch. In irrigating young trees the water is never put directly on the roots, but in shallow ditches to the side.

I see some nice young plantings of teakwood. These are now five years old and are 8 to 10 inches d.b.h.

The workers at this station live in attached brick cottages. Behind them are unattached individual small rectangular kitchen houses. Behind these are small graneries on poles.

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I am sorry that the time is so short because this is an interesting station. They have a large collection of citrus varieties, including orange, mandarin, grapefruit, and lemon, as well as other fruits and nuts. I am impressed that their cultural operations and measurements are very carefully and accurately carried out. With so many trees, the work load is very large. Besides cultural experiments are a great many grafting experiments. It is planned to begin breeding work soon. Although mangoes can be grown on the uplands, most of the fruits are confined to the alluvial soils which are, for the most part, imperfectly drained clays and clay loams.

We go to the train -- the same one we left yesterday, only 24 hours later -- and leave for Matadi about noon. This railway is operated almost entirely by natives. Except at the two terminals, the station masters are natives. The stations are very clean and neat and each is well planted with ornamentals. I have never seen such nice small stations in the United States.

All the train crew, including the engineer, are natives. A special control system is used that makes it impossible for an engineer to go by any station with a train between that station and the next one. Europeans and natives ride in different coaches on the train. This is obviously necessary.

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From the train I see a fairly large sugarcane plantation. The cane seems to me to be a little short. I am told that soil productivity is maintained through the use of compost.

Along the railroad are both large and small areas of terrace. Some of these have dark brown or dark grayish-brown soils like those used for sugarcane. But most of the soil is yellow, with or without lateritic hardpan in the lower part. In the coves and slightly lower places in both terraces and uplands, cassava seems to be the only food crop now. Perhaps maize comes later. Generally the land is nearly open savanna with very little forest.

In the railway cuts through the yellow soil I see layers of laterite from 2 to 6 feet thick which are essentially parallel with the curved ground surface. From the train I cannot determine whether these are simply compact mixtures of concretions and clay or whether semi-indurated hardpans, but I think the former. A little later on the train stops near a cut and I find this thick layer to be a mass of unconsolidated soil material and concretions -- thus hardly lateritic hardpan since it has not hardened even after long exposure.

As we go west from Songololo this lateritic layer becomes gradually thicker and more nearly indurated. The

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overlying soil is predominantly yellow with some yellowish-brown and orange-red. In a few cuts the compact concretionary layers are 10 to 15 feet thick and some of them contain indurated masses. Even these are roughly parallel to the curved surfaces of the hills. This might be taken as evidence that certain kinds of lateritic concentration zones are formed in place on hilly land. Or is the great mass an inheritance from a previous period of poorer drainage and only the present yellow solum has developed from this material during the current stage in the geomorphic cycle?

In the hilly areas one often sees conspicuous gully erosion, sometimes accompanied by slips, in this region where there is now neither grazing nor cultivation. Only trees would hold this soil, if there is any point in holding it. After the erosion has taken place in these spots, trees come in naturally because the new surface is so much more productive than the old soil -- a dramatic example of renewal of soil productivity through drastic erosion.

A few kilometers east of Matadi the railway goes through hilly rocky land. The soil is thin and part of it is red. The hills are covered with nearly pure savanna except for narrow forest galleries in the deep valleys. In these I see some cropping with bananas, cassava, maize, and a few oil palm. We break out of the hills on to the margin

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July 4: Matadi to Gimbi Station;[a] then to Kondo Station

I am awakened at 5:45 with sirens, whistles, and bells all over the place. Matadi is a little port town on a hill beside the Congo at the upper limit of navigation from the sea. The main enterprise is the transfer of freight between boats and trains.

We start out to go north of Matadi into the Mayumbe region and cross the river at 8:15 on a ferry. Here the river simply boils. It is said that 30,000 - 60,000 cubic meters of water pass each second. Beyond the river is very hilly thin soil developed from schist. Some soils are yellow, some orange, and some red. The road has a red surface of lateritic concretions and now, during the dry season, the red dust covers everything. The cover is mostly open savanna with a few forest galleries, thin near the river but broader as we get back from the river. It is said that there are too many trees to permit cattle grazing on account of the Tsetse fly.

About 16 kilometers north we pass on to an area of hilly deep red soil as we climb to the high plateau. On the plateau the natives grow some cassava, sweet bananas, and a few garden patches of sugarcane, oil palm, peanuts, and maize near the villages. Their main crops of bananas are grown within the forest galleries.

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[a] Elevation is about 1,500 feet and annual rainfall about 47 to 51 inches.

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K-1451 July 4, 1947
Belgian Congo. 30 kilometers north of Matadi. Deep exposure of laterite. The surface is reddish-brown clay underlain by a loose mixture of concretions, being taken for road material, and large, hard, completely indurated blocks.

K-1452 July 4, 1947

Belgian Congo. 30 kilometers north of Matadi.
Deep exposure of laterite. The surface is
reddish-brown clay underlain by a loose mixture
of concretions, being taken for road material,
and large, hard, completely indurated blocks.

In this region north of Matadi there are said to be three main peneplains -- one at 300 meters, one at 500, and one at 800. The one at 500, which we shall see at Gimbi, is thought to be covered with old alluvium.

The soils on this plateau -- the intermediate one -- are partly very yellow and partly very red with deep valleys having gallery forests. Some of these galleries are very wide and cover the floor of the valley as well as parts of the long slopes.

At 30 kilometers we stop at a large borrow pit of laterite. The surface soil is reddish-brown clay with subangular nut structure. The deep subsoil below 2 or 3 feet is a loose mixture of lateritic concretions and huge blocks of indurated masses of concretions. The loose material is being taken for road surfacing.

We drive on to the Gimbi station located on the top of this plateau. The smoother places are undulating yellow lateritic soils. The main enterprise here is sisal.

M. Donis and I go out in the field with M. J. Breynaere, the Director, and M. Wagemans, a visitor.

Mechanized agriculture might be possible on these smooth plateaux. Other parts of the region are too hilly, except for the marshy plains along the Congo to the east that would require drainage.

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Part of the soils on this plateau are yellow and part are red. There is considerably more forest here on the slopes than nearer the Congo. On the station where the savanna has been protected from fire, the forest is spreading from the galleries quite rapidly.

For some reason sisal is almost a complete failure on the red soils of the plateau, but does fairly well on the yellow soil. Unfortunately, most of the early plantings were made on the red soil and there is not a large area of the yellow soil on the station grounds. Present opinion is that the roots of the sisal cannot penetrate the fairly compact horizons in the upper part of the red soils.

I look at the yellow lateritic soil in a nearly level area which may even be slightly depressed. The vegetation is savanna.

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Soil Profile Sample No. 42

A_0	¼ - 0"	Brown coarse loose mat of savanna leaves and stems. (Not sampled)
$A_{1(P)}$	0 - 4" (3-8")	Dark yellowish-brown silty clay; firm, but fairly easily friable; many roots and insect holes. (Brown when dry)
A_3	4 - 10" (9-12")	Yellowish-brown silty clay; digs out in fairly easily friable sub-angular nut.
B_1	10 - 20"	Light to medium yellowish-brown silty clay; structure as above. (Reddish-yellow when dry)
B_2	20 - 48"	Yellow to light yellowish-brown easily friable clay; somewhat firm in place. (Reddish-yellow when dry). Grades into:
C	48 - 60" plus	Softer and slightly moist mellow yellow clay. (Reddish-yellow when dry)

I look also at the principal red soil developed under the forest. The land is very gently undulating and the forest is an extension of gallery over the edge of the plateau:

A_P	0 - 10"	Slightly reddish, brown clay; mixture of fine hard granular and irregular nut; friable with difficulty.
A_3	10 - 24"	Rather light reddish-brown clay; firm in place; poorly developed irregular nut.
B_2	24 - 72"	Light reddish-brown to yellowish-red clay; firm in upper part gradually becoming less so in the lower part.
C	72 - 90" plus	Soft mellow yellowish-red to reddish-brown clay.

Soil Profile Sample No. 42

A_0	$\frac{1}{2}$ - 0"	Brown coarse loose mat of savanna leaves and stems. (Not sampled)
$A_{1(P)}$	0 - 4" (3-8")	Dark yellowish-brown silty clay; firm, but fairly easily friable; many roots and insect holes. (Brown when dry)
A_3	4 - 10" (9-12")	Yellowish-brown silty clay; digs out in fairly easily friable angular nut.
B_1	10 - 20"	Light to medium yellowish-brown silty clay; structure as above. (Reddish-yellow when dry)
B_2	20 - 48"	Yellow to light yellowish-brown easily friable clay; somewhat firm in place. (Reddish-yellow when dry). Grades into:
C	48 - 60" plus	Softer and slightly moist mellow yellow clay. (Reddish-yellow when dry)

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Table 11. Analyses of Yellow Latosol. (42)

Sample No.	Horizon	Depth	pH	Organic ~~Matter~~ Carbon	Size Class and Diameter of Particles (*in mm.*)							Other Classes (*in mm.*)		
					Very coarse sand 2–1	Coarse sand, 1–0.5	Medium sand, 0.5–0.25	Fine sand, 0.25–0.1	Very fine sand, 0.1–0.05	Silt, 0.05–0.002	Clay, <0.002	0.02–0.002	<0.005	>2
		Inches		*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
471643	$A_1(p)$	0–4	4.4	3.4	2.1	3.0	1.7	2.6	1.3	3.5	85.8	4.4	87.2	0
1644	A_3	4–10	4.4	1.6	2.2	3.5	2.1	3.0	1.1	1.7	86.4	2.2	86.8	0
1645	B_1	10–20	4.6	1.1	2.0	2.7	1.4	2.5	1.0	4.3	86.1	2.3	86.3	2
1646	B_2	20–48	4.8	0.4	2.1	2.8	1.4	1.7	0.9	2.1	89.0	2.0	89.0	0
1647	C	48–60+	4.6	0.3	2.5	2.8	1.4	2.7	1.4	2.8	86.4	3.8	87.2	0

Sample No.	Horizon	Depth	Exchangeable Cations me/100 g					Sum of Cations me/100 g	% Base Saturation
			Ca	Mg	Mn	K	H		
471643	$A_1(p)$	0–4	0.2	0.3	0.16	0.3	20.7	21.7	5
1644	A_3	4–10	0.2	0.1	0.08	0.2	14.2	14.8	4
1645	B_1	10–20	0.5	0.2	0.08	0.2	10.6	11.6	9
1646	B_2	20–48	0.1	0.2	0.07	0.2	8.1	8.7	7
1647	C	48–60+	0.3	0.2	0.13	0.3	7.7	8.6	10

Sample No.	Horizon	Depth	Total P	Available P
			%	ppm.
471643	$A_1(p)$	0–4	.088	19
1644	A_3	4–10	.052	1
1646	B_2	20–48	.043	2
1647	C	48–60+	.009	2

Sample No.	Thermal Analysis Data		
	Particle Size Analyzed	Minerals Present	
		Kaolinite ~~Type~~	
		%	
471643	Total soil	85	

Congo Soil Profile No. 42

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Table III. Analyses of Lateritic Soils (Cont.)

Sample No.	Horizon	Depth Inches	pH	Organic Carbon Per Cent	Very coarse sand 2-1	Coarse sand 1-0.5	Medium sand 0.5-0.25	Fine sand 0.25-0.1	Very fine sand 0.1-0.05	Silt 0.05-0.002	Clay 0.002	Organic Matter 0.2-0.002	Organic Matter <0.002	Organic Matter <2
47565	A_1(p)	0-4	4.4	3.4	2.1	3.0	1.7	2.6	1.3	3.3	83.8	4.4	87.3	87.3
47566	B_1	4-10	4.6	1.6	2.8	3.2	3.1	3.0	1.1	1.7	85.4	2.2	88.3	88.3
47567	B_2	10-30	4.6	1.1	3.0	2.7	2.5	1.9	1.0	4.3	86.1	2.3	88.3	88.3
47568	B_3	30-48	4.8	0.4	1.4	3.8	1.4	1.4	0.9	2.1	89.0	0.0	89.0	89.0
47569	C	48-90+	4.6	0.3	2.3	2.8	1.7	2.7	1.4	2.8	86.4	3.8	87.3	87.3

Thermal Analysis Data

Particle Size Analysis Data

Sum of Centisome Base Saturation

Exchangeable Cations m.e./100 g.

Ca	Mg	Mn	K	H m.e./100 g.	S	T	V
0.3	0.2	0.16	0.3	20.7	0.7	21.4	3
0.3	0.1	0.08	0.3	14.5	0.8	15.3	5
0.2	0.2	0.08	0.2	10.6	0.6	11.2	5
0.2	0.2	0.07	0.2	8.7	0.5	9.2	5
0.2	0.2	0.15	0.2	4.4	0.8	5.2	15

Total Available

%	ppm.	%	ppm.	%	ppm.
.008	79	.006	57	.002	19
.006	57	.004	38	.002	19
.004	38	.002	19	.002	19
.004	38	.002	19	.002	19
.004	38	.002	19	.002	19

Total Nitrogen

Organic Matter Classes (in mm.)

>2	2-0.05	0.05-0.002	<0.002
0	12.7	87.3	87.3
0	11.7	88.3	88.3
0	11.7	88.3	88.3
0	11.0	89.0	89.0
0	12.7	87.3	87.3

Soil Type

Total Nitrogen

Total Phosphorus

Total Potassium

Total Calcium

Total Magnesium

Total Manganese

Total Iron

Total Aluminum

Total Titanium

Total Sodium

K-1452 July 4, 1947
Belgian Congo. Gimbi. Savanna not burned since 1939 on yellow lateritic soil. (Site of soil sample No. 42)

K-1453 July 4, 1947
Belgian Congo. Gimbi. Right foreground shows poor spot in sisal planting where soil is nearly massive. (Site of soil sample No. 43)

K-1452 July 4, 1947
Belgian Congo. Gimbi. Savanna not burned since 1939 on yellow laberitic soil. (Site of soil sample No. 42)

K-1453 July 4, 1947
Belgian Congo. Gimbi. Right foreground shows poor spot in sisal planting where soil is nearly massive. (Site of soil sample No. 43)

This area was cleared in 1945 and now has Montana tung trees, bananas, and pueraria for ground cover, along with some remnants of the forest gallery in the background. This is considered to be a good soil but not, I gather, for sisal.

In a road cut on a steep slope the surface soil is dark reddish-brown for 6 to 8 inches. This is underlain by reddish-brown rather compact clay. I see enormous lateritic boulders at 2 to 15 feet but I believe these came from a fossil lateritic hardpan formed during a previous period of weathering and soil formation. I take a special sample of the red lateritic hardpan. There is a nice forest growing on this deep slope.

I sample another red soil distinctly up on the plateau, which is said to be much poorer for sisal than its yellow associate -- sample No. 42. The land is nearly level. It was cleared from savanna and planted to sisal in 1941. The poorer spots where the soil is most compact show up distinctly in the crop. There is no lateritic hardpan.

This area was cleared in 1945 and now has Montana tung trees, bananas, and pueraria for ground cover, along with some remnants of the forest gallery in the background. This is considered to be a good soil but not, I gather, for oiasi.

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Soil Profile Sample No. 43

A_P	0 - 8" (5-9")	Reddish-brown clay; a loose mixture of granular and rather hard nut; many roots.
A_3	8 - 15" (13-18")	Reddish- and yellowish-brown clay; compact in place and digs out in small hard nut; only a few roots. (Yellowish-red when dry)
B_2	15 - 36"	Yellowish-brown clay with slight tinge of red; firm, but fairly friable when removed. (Reddish-yellow when dry)
C	36 - 60" plus	Yellowish-brown clay with slight tinge of red; quite firm but "springy" in place; soft and mellow when removed. (Reddish-yellow when dry)

Root penetration is very poor. The soil has poor structure, in fact, not much structure at all. The total effect is nearly massive from the A_3 down; and the A_p is loose and dry. Thus plants have most of their roots in this loose dry surface soil during the dry season. I see considerable evidence of termites in the A_p, but practically none below that.

I step over and look at the yellow soil where the sisal is growing well. There are no differences in surface features.

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A_p	0 - 8" (5-9")	Reddish-brown clay; a loose mixture of granular and rather hard mut; many roots.
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I step over and look at the yellow soil where the sisal is growing well. There are no differences in surface features.

Table 12. Mechanical analyses of Yellow Latosol-Red Latosol transition. (43)

Sample No.	Horizon	Depth	pH	Organic Matter by H_2O_2	Size Class and Diameter of Particles (*in mm.*)							Other Classes (*in mm.*)		
					Very course sand 2–1	Coarse sand, 1–0.5	Medium sand, 0.5–0.25	Fine sand, 0.25–0.1	Very fine sand, 0.1–0.05	Silt, 0.05–0.002	Clay, <0.002	0.02–0.002	<0.005	>2
		Inches		*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
471648	A_p	0–8	4.4	3.3	1.0	2.1	1.4	2.2	0.7	1.6	91.0	1.8	91.2	0
1649	A_3	8–15	4.5	2.0	0.7	1.7	1.8	3.2	1.5	2.3	88.8	3.6	89.4	0
1650	B_2	15–36	4.7	0.7	0.8	1.7	1.0	1.8	1.0	7.9	85.8	6.2	86.6	0
1651	C	36–60+	5.1	0.1	2.3	2.0	1.0	1.7	0.8	18.4	73.8	14.5	76.9	0

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Table 12. Mechanical Analyses of Yazoo Silt Loam Profiles Described in Soil Survey Report

Sample No.	Horizon	Depth	pH	Organic Matter	Very coarse sand 2-1 mm.	Coarse sand 1-0.5 mm.	Medium sand 0.5-0.25 mm.	Fine sand 0.25-0.1 mm.	Very fine sand 0.1-0.05 mm.	Silt 0.05-0.005 mm.	Clay <0.005 mm.	1.0-0.5 mm.	0.5-0.25 mm.	0.25-0.1 mm.	0.1-0.05 mm.	0.05-0.005 mm.	0.005-0.002 mm.	<0.002 mm.
47856	A	0-8	4.2	1.0	0.1	1.5	4.8	5.3	0.9	7.1	9.0	0.0	0.0	0.0	0.0	8.2	1.8	91.8
47857	B	8-15	4.2	0.5	0.0	1.7	4.8	5.3	0.9	7.3	8.8	0.0	0.0	0.0	0.0	8.3	2.8	91.2
47858	C	15-30+	4.4	0.3	0.0	1.7	4.8	5.3	0.9	7.3	8.8	0.0	0.0	0.0	0.0	8.3	2.7	91.3
Test																		

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Sample No.	Horizon	Depth	pH	Organic Matter	Very coarse sand 2-1 mm.	Coarse sand 1-0.5 mm.	Medium sand 0.5-0.25 mm.	Fine sand 0.25-0.1 mm.	Very fine sand 0.1-0.05 mm.	Silt 0.05-0.005 mm.	Clay <0.005 mm.	1.0-0.5 mm.	0.5-0.25 mm.	0.25-0.1 mm.	0.1-0.05 mm.	0.05-0.005 mm.	0.005-0.002 mm.	<0.002 mm.
47859	A	0-8	4.3	1.0	0.1	1.7	4.8	5.3	0.9	7.1	9.0	0.0	0.0	0.0	0.0	8.2	1.8	91.8
47860	B	8-15	4.3	0.5	0.0	1.7	4.8	5.3	0.9	7.3	8.8	0.0	0.0	0.0	0.0	8.3	2.8	91.2
47861	C	15-30+	4.4	0.3	0.0	1.7	4.8	5.3	0.9	7.3	8.8	0.0	0.0	0.0	0.0	8.3	2.7	91.3
Test																		

A_p	0 - 9"	Dark brown softly granular silty clay or clay; many roots.
A_3	9 - 17"	Dark yellowish-brown silty clay; firm but friable; digs out in clods that fall easily into small nut.
B_1	17 - 23"	Light yellowish-brown clay mottled with brown; fairly compact, but friable.
B_2	23 - 45"	Yellow to light yellowish-brown clay; somewhat firm in place, but easily friable when removed. Grades into:
C	45 - 65" plus	Like the above but softer and more mellow.

Most of the roots are in the A but some go down 3 or 4 feet. This soil has much better structure and moisture than the previous one.

Only 150 feet away the sisal is poor where the soil is slightly more reddish and somewhat more compact near the surface. Here again only a few roots penetrate beyond the very surface A_p. I am told that chemical analyses indicate these soils to be acid, especially the red soils. They have pH values from 3.9 to 6.0.

We go to lunch with the Director and several guests.

After lunch we go out to another part of the station where rubber and other crops are also under trial.

First I look at a red soil in this section on gently undulating relief. Originally the land was forest. This was followed by savanna. The land was cleared and rubber trees and bananas planted in 1942. The rubber was grafted that same year.

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A_P	0 - 5½"	Granular very dark reddish-brown clay or clay loam.
A_{30}	5½ - 12"	Reddish-brown granular clay loam; slightly firm, but friable.
A_{31}	12 - 18"	Slightly lighter reddish-brown clay; firm and granular.
B	18 - 50"	Red clay; slightly firm, but easily friable to soft granular. Grades into:
C	50 - 65" plus	Red, easily friable clay.

Roots go beyond 60 inches and insect holes as well.

I look at another profile nearby where the original forest had been heavier. There are many old deep root channels. This soil appears to be productive but it is somewhat less red and the soil is somewhat more compact than the last one. I doubt if all the difficulty with these red soils here can be laid to compaction.

Here they are planting a good deal of the rubber on rather strong slopes up to 40 percent with the use of individual terraces. In some places bananas are planted with the rubber. In some experiments these are harvested, and in others they are not harvested. Following bananas, the natural vegetation is allowed to come in for ground cover.

On this station are 125 hectares of sisal, 20 hectares of native fibers, 75 hectares of bananas, 200 hectares of rubber, and 5 hectares of manila hemp (abaca). Manila hemp

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K-1454 July 4, 1947
Belgian Congo. Gimbi. Hevea rubber planted in 1942 under bananas. Grafted in 1944. No bananas harvested and wild cover allowed to come in to keep soil shaded and productive.

K-1454 July 4, 1947

Belgian Congo. Climbi. Heves rubber planted in 1942 under bananas. Grafted in 1944. No bananas harvested and wild cover allowed to come in to keep soil shaded and productive.

K-1531 July 4, 1947
Belgian Congo. Gimbi station. Manila hemp planted within good gallery forest.
Trees are Terminalia superba.

K-1531 July 1, 1947
Belgian Congo. Gimbi station. Manila hemp
planted within good gallery forest.
Trees are Terminalia superba.

is attacked here by a pest that also affects bananas. At the station over 20 varieties of rubber are under observation.

I see another plot of rubber seedlings planted on a 30 to 40 percent slope of the red soil with contour terraces. The bananas are two years old and it is planned to harvest five crops.

I see a beautiful stand of manila hemp planted in a partially cleared forest gallery. The main trees are Terminalia superba.

In 1942 a mixed planting of sisal and bananas was made following a thin forest. But the Director thinks that bananas give no significant advantage. Of course, one trouble with sisal is the same as the trouble with pyrethrum: the crop requires strong sunlight. This means that the soil is not shaded enough to maintain productivity. The temperature at the surface must become very high with serious effects on the soil organisms.

I wonder why there are almost no termite mounds to be seen anywhere I have been so far in the Low Congo.

At the station they have tried raising cattle but the sleeping sickness made the project impracticable.

About four o'clock we leave the Gimbi station for the Kondo station, some distance to the west. For the first few

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K-1455 July 4, 1947
Belgian Congo. Gimbi. Hevea rubber seedlings planted for one year on 30 to 40 percent slope of red lateritic soil with contour terraces. Bananas are 2 years old and 5 crops will be harvested before wild plants take over as cover.

K-1455 July 4, 1947
Belgian Congo. Gimbi. Heves rubber seedlings
planted for one year on 30 to 40 percent slope
of red lateritic soil with contour terraces.
Bananas are 2 years old and 5 crops will be
harvested before wild plants take over as cover.

miles the cover is savanna with large forest galleries, and then nearly all forest.

This is a difficult ride. We have a nearly new Ford pickup with exceedingly stiff springs for very rough country roads. These were not designed for people with arthritic backs! We reach the Kondo station about 6:30, well after dark, and very tired. I finally get to bed at 10 o'clock.

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K-1456 July 5, 1947
Belgian Congo. Kondo. Hevea rubber on contour with individual terraces on red lateritic soil. Planted in 1941.

K-1456 July 5, 1947
Belgian Congo. Kondo. Heves rubber on
contour with individual terraces on red laterite
soil. Planted in 1941.

K-1457 July 5, 1947
Belgian Congo. Kondo. General view of part of experiment station. National forest for cacao in lefr background, then oil palm, banana in center, and young rubber in foreground.

K-1458 July 5, 1947 Belgian Congo.
Kondo. Cacao planting on heavy orange-red lateritic soil with 30 percent slope. Trees planted in March 1942, with contour terraces, in partially cleared forest with natural ground cover.

K-1457 July 5, 1947
Belgian Congo. Kondo. General view of part of experiment station. National forest for cacao in left background, then oil palm, banana in center, and young rubber in foreground.

K-1458 July 5, 1947 Belgian Congo.
Kondo. Cacao planting on heavy orange-red lateritic soil with 30 percent slope. Trees planted in March 1942, with contour terraces, in partially cleared forest with natural ground cover.

July 5: Kondo Station[a]

I am up at dawn for a very early breakfast as we have much to see today. Immediately after breakfast I go over the Station with M. Donis and the Director, M. A. Van Dale.

At both Kondo station and Gimbi station the dry season runs from May to October. This is also the coolest period. At the same time, the relative humidity remains very high so the air during the dry season has the lowest deficiency of saturation. Thus the dryness of the soil is partly compensated for by the high humidity of the air. There is also a short period of low rainfall in January, and, again, the corresponding low saturation deficiency. There is great variation from year to year in the amount of rainfall during the rainy season. Most of the station is rolling to hilly except for a few very narrow terraces and alluvial bottoms. All of it was forested.

First I look at a profile of red soil on rolling land in a young oil palm plantation. The profile is on a 5 percent slope. The forest was felled in 1941. The palms were planted at once without burning. There is a heavy ground cover of pueraria. The land was not plowed but, of course, the surface has been disturbed a bit. The soil is dry now.

---

[a] Elevation about 600 meters and rainfall about 47 inches.

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---

[a] Elevation about 600 meters and rainfall about 47 inches.

Soil Profile Sample No. 44

A_P	0 - 1½"	Dark reddish-brown granular sandy clay loam; digs out in brittle, easily friable spongy clods; very porous. (Reddish-brown when dry)
A_3	1½ - 9"	Reddish-brown sandy clay; roughly prismatic; clods hard but fall into fairly easily friable irregular nut; the outsides of the large prisms are dark reddish-brown; these aggregates have colloidal coatings and the roots are in the cracks; many old root holes and insect holes.
B_{10}	9 - 21"	Similar to the above, but lighter in color in place, because of less coatings. But the cracks continue and the roots are largely in the cracks. (Red to reddish-yellow when dry)
B_{11}	21 - 27"	Red to reddish-brown coarse sandy clay. The cracks end here but some roots go on through the soil; nearly massive in place, but fairly easily friable.
B_2	27 - 53"	Massive mixture of heavy red clay, coarse angular sand, and subangular quartz pebbles up to small cobble size.
B_3	53 - 65"	Massive, slightly firm coarse sandy red clay with a few quartz pebbles.
C	65 - 80" plus	Soft easily friable red sandy clay; some fine mica.

Probably the soil is developed from gneiss or schist rocks. Most of the roots are above B_2, but a few get through it into the C. Small pieces of charcoal may be seen in the lower A_3. I note a few pieces of black pottery firmly imbedded in B_2 that must be very old indeed. There are few quartz fragments and pebbles throughout the profile and a few on the surface.

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Table 2. Mechanical Analyses of Red Latosol (44)

Sample No.	Horizon	Depth	pH	Organic Matter by H_2O_2	Size Class and Diameter of Particles (*in mm.*)							Other Classes (*in mm.*)		
					Very coarse sand 2–1	Coarse sand, 1–0.5	Medium sand, 0.5–0.25	Fine sand, 0.25–0.1	Very fine sand, 0.1–0.05	Silt, 0.05–0.002	Clay, <0.002	0.02–0.002	<0.005	>2
		Inches		*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
471652	A_p	0–1½	6.9	3.8	10.8	14.2	10.8	18.5	4.7	8.2	32.8	6.2	35.9	0
1653	A_3	1½–9	6.1	1.2	10.0	13.0	10.4	18.8	4.6	7.9	35.3	5.7	38.4	0
1654	B_{10}	9–21	5.1	0.6	12.5	13.2	7.4	12.0	3.0	7.5	44.4	4.5	47.0	0
1655	B_{11}	21–27	5.0	0.3	21.5	9.8	4.8	8.6	2.4	5.5	47.4	3.9	49.7	0
1656	B_2	27–53	5.4	0.3	18.9	8.4	3.4	3.0	4.0	7.4	54.9	6.1	57.9	63
1657	B_3	53–65	5.7	0.0	18.8	8.2	3.7	6.7	2.4	11.3	48.9	10.0	53.5	44
1658	C	65–80+	4.9	0.1	11.4	9.0	5.2	9.9	3.6	25.5	35.4	19.0	43.4	5

Congo Soil Profile No. 44

U. S. GOVERNMENT PRINTING OFFICE 16—46512-2

Some Soil Profile No. 44

TABLE 2.—MECHANICAL ANALYSES OF HEAVY LAYCOCK (44)

Sample No.	Depth	Horizon	pH	Organic Matter	Sand Class (2 mm–0.05 mm)						Silt 0.05–0.002 mm	Clay <0.002 mm	Fine Clay <0.0002 mm	Total <2 mm
					Very coarse sand 2–1	Coarse sand 1–0.5	Medium sand 0.5–0.25	Fine sand 0.25–0.1	Very fine sand 0.1–0.05	Total sand 2–0.05				
	in.				per cent	per cent	per cent	per cent	per cent	per cent	per cent	per cent	per cent	per cent
44	0–7	Ap	6.3	2.8	8.8	14.5	10.8	18.2	4.2	56.5	28.3	15.2	5.3	100
44	7–13	A3	6.1	1.3	10.0	12.3	10.4	18.3	4.0	55.0	29.4	15.6	5.4	100
44	13–21	B1	6.2	0.8	12.5	13.3	7.4	15.0	4.3	52.5	28.3	19.2	6.3	100
44	21–32	B2	6.4	0.3	15.8	8.8	8.8	8.8	4.3	46.5	27.3	26.2	8.3	100
44	32–63	C	7.2	0.0	18.8	8.8	7.4	8.8	4.3	48.1	32.3	19.6	6.4	100
44	63+		7.8	0.0	17.4	9.8	8.8	9.8	4.2	49.4	32.4	18.2	5.9	100

Some Class and Diameter of Particles in Millimetres (mm and mm²)

Organic Matter

Depth

Horizon

pH

Sand Class (2 mm–0.05 mm)

Silt 0.05–0.002 mm

Clay <0.002 mm

Fine Clay <0.0002 mm

Total <2 mm

S-6000-3—12-10-43—Modern Printing Co., Ltd.

This soil is said to be a common one but not quite so productive for oil palm as others to be seen. Here they are using contour terraces.

We go into a Hevea rubber plantation with the trees planted on the contour behind individual terraces. Roots of the trees are partially exposed and are treated with 5 percent copper sulphate brushed on the roots every four months, beginning the second year, to protect them against fomes. With this treatment they now have only 3 percent total mortality from this disease and all others.

All the trees are measured for growth and later are tapped separately. All those below average are felled.

I look at another profile where the soil was cleared from the forest and planted to rubber in November 1942. This soil is said to be somewhat more productive than where sample No. 44 was taken. The profile is part way down a long 5 percent slope.

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A_P	0 - 1"	Dark reddish-brown granular sandy clay loam; digs out in brittle, easily friable clods; porous.
A_3	1 - 16"	Reddish-brown, with tinge of yellow, sandy clay; slight vertical cracking; soil digs out in fairly easily friable irregular nut; many roots, insect holes, and small specks of charcoal.
B_2	16 - 50"	Reddish and yellowish-brown sandy clay; massive and fairly firm in place, but digs out in small irregular nut quite easily friable; some small specks of charcoal; a very few quartz pebbles; quite a few small root channels.
B_3	50 - 65"	Transitional; less firm.
C	65 - 85" plus	Red sandy clay mottled with yellow; rather soft but firm; easily friable.

Roots go to 6 feet but are concentrated in the A and upper B.

There are many experiments here with 26 varieties of rubber. They first planted the plots with stock to establish the average growth and then chose three plots of the same average stock for each variety to account for soil variability. They use the same principle with the oil palm. Similar trials are made at Yangambi and Ubangi, a smaller station. As might be expected, different varieties gave best results at the three places. So far here at Kondo only growth measurements have been made.

In a nearby valley is a deep cut to the weathering gneiss-schist. It is only possible to find the hard rock with

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In a nearby valley is a deep cut to the weathering gneiss-schist. It is only possible to find the hard rock with

the weathered rock just above it where the soils have abnormally thin solums. The soil is on a slope of 50 to 70 percent.

Soil Profile Sample No. 45

A_1	0 - 10"	Brown sandy clay loam of colluvial origin from farther up the slope.
A_3	10 - 24"	Streaked yellowish-brown and reddish-brown sandy clay loam.
B_2	24 - 34"	Red friable sandy clay with much mica (Special sample taken in a brass tube).
C_1	34 - 52"	Streaked yellowish-brown and yellow rotten rock.
C_2	52 - 60"	Reddish-pink rotten rock.
C_3	60 - 108"	Gray streaked medium and light gray rotten rock. (Special sample taken in brass tube - 890)
D		Nearby I obtain a sample of the hard rock, but, of course, I cannot be absolutely certain that it is the mother rock although I think so.

I take a general view of the station from a high slope of about 30 percent. Here I look at the red soil over quartz stones and cobbles mixed with clay. This tract was cleared from the forest in 1945 and planted to rubber. Likely this soil should be regarded as a lithosolic phase of profile No. 44. The soil is less compact and has much better root penetration. In fact, it illustrates beautifully the maintenance of productivity through natural erosion.

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cleared from the forest in 1945 and planted to rubber.
Likely this soil should be regarded as a lithosolic phase
of profile No. 44. The soil is less compact and has much
better root penetration. In fact, it illustrates beautifully
the maintenance of productivity through natural erosion.

K-1532 July 5, 1947
Belgian Congo. Kondo. Examining profile of lateritic orange-red soil in 5 year rubber plantation.

K-1232 July 5, 1947
Belgian Congo. Kondo. Examining profile of laterite orange-red soil in 5 year rubber plantation.

K-1459 July 5, 1947
Belgian Congo. Kondo. Cacao tree 5 years old with gray fruits.

K-1459 July 5, 1947
Belgian Congo. Kondo. Cacao tree 5 years old
with gray fruits.

K-1460 July 5, 1947
Belgian Congo. Luki. View of forest along road. Big trees are Alstonia; tall one near road is kapok; while ones in background are Terminalia; and small ones with umbrella-like leaves are Musanga Smithii.

K-1450. July 5, 1917
Belgian Congo. Luki. View of forest along road. Big trees are Alstonia; tall one near road is kapok; white ones in background are Terminalia; and small ones with umbrella-like leaves are Musanga Smithii.

A_P	0 - 1½"	Dark reddish-brown sandy clay loam; digs out in brittle chunks easily friable to granular.
B_1	1½ - 15"	Reddish-brown sandy clay; digs out in irregular fairly easily friable nut; many root and insect holes; some vertical cracking;a few bits of charcoal.
B_2	15 - 30" (30-38")	Red, with orange tint, sandy clay; digs out in small irregular nut easily friable; some charcoal; some rounded dark brown concretions.
B_3	30 - 50"	Orange-red to red friable sandy clay; some pebbles of quartz.
C	50 - 80" plus	Mixture of red clay and nearly angular pebbles and stones of partially weathered quartz. For quartz, these are easily crushed.

Roots are concentrated in the A, B, and upper C.

We go down to a kind of botanical garden in order to look at a collection of various plants under observation -- plants that might have some possibility in the Congo. These include vanilla, black pepper, etc. I see two interesting ones that produce nuts, the oils of which are useful in treating leprosy: Hydnocarpus anthelmentica and Caloncoba welwitshii.

While waiting for lunch we look at the Director's farm yard where he has goats,chickens, turkeys, guinea fowl, peacocks, and rabbits.

At lunch the Director says that bananas yield as follows on the hilly land per hectare:

A_p	0 - 12½"	Dark reddish-brown sandy clay loam; digs out in brittle chunks easily friable to granular.
B_1	12½ - 15"	Reddish-brown sandy clay; digs out in irregular fairly easily friable nut; many root and insect holes; some vertical cracking; a few bits of charcoal.
B_2	15 - 30" (30-38")	Red, with orange tint, sandy clay; digs out in small irregular nut easily friable; some charcoal; some rounded dark brown concretions.
B_3	30 - 50"	Orange-red to red friable sandy clay; some pebbles of quartz.
C	50 - 80" plus	Mixture of red clay and nearly angular pebbles and stones of partially weathered quartz. For quartz, these are easily crushed.

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1st year	-	10 tons
2nd year	-	8 tons
3rd year	-	6 tons
4th year	-	4 tons

On the low terraces the yields are about 20 percent more. Bananas here are not fertilized or given compost, but are mulched with natural growth collected on the spot. In one plot having a low yield of 3 tons in the seventh year, extra mulch was given and after two years the yield went up to 8 tons.

All the oil palm plantings here are young, but the early production indicates that they will do well here, at least as good as at Yangambi.

In the Mayumbe region the Director estimates about 1,000 hectares of robusta coffee, about 2,000 hectares of bananas, rubber, and cacao, about 8,000 hectares of plantation oil palm, and some cinchona. The natives have about 4,000 hectares of oil palm and perhaps 200 hectares of rubber. The native food crops are principally bananas, cassava, peanuts, maize, sweet potatoes, a little sugarcane, and some pineapples.

After lunch I look at a plantation of cacao under the shade of partially cleared forest. The trees are planted with contour terraces on orange-red heavy lateritic soil on about 30 percent slope. These were planted in March 1942. Some of the trees have gray fruits and some red fruits.

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The main trees are Celtis, Cistanthera, Fagara, Terminalia, and Ceiba. I estimate these give about 80 percent shade. The chief pest here of the cacao is an insect, Sahlberghella. The kind of trees left for shade have an influence on this insect. They have had good results by eradicating the Ricinodendron trees. All the cacao trees have individual records of growth, color, size, and number of fruits in order to find the best strains for plantations in this area.

I look at some specially good oil palm four years old on dark-colored imperfectly drained alluvial soil.

I look at a profile of red lateritic soil that must be rather near real laterite, assuming this group is retained. This profile is in a coffee plantation near the top of a slope of about 2 percent. Robusta coffee was planted in 1942 under the shade of Leucona glauca. Small plants of this same species are kept pruned as a hedge around each coffee plant which has an individual terrace. The coffee plants are pruned with a single stem and are set 3 meters by 3 meters.

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A_p	0 - 1½"	Dark reddish-brown granular sandy clay loam; brittle, porous, and easily friable.
A_3	1½ - 15"	Reddish-brown sandy clay loam; vertical cracking; dark reddish-brown coatings on sides of cracks; digs out in fairly friable irregular nut; many roots and insect holes; a few quartz pebbles; some small fragments of charcoal.
B_2	15 - 45"	Slightly yellowish, red sandy clay; rather firm in place but digs out in easily friable chunks; considerable coarse sand; a few very small concretions; quite a few roots; a few quartz pebbles.
B_3	45 - 60"	Red coarse sandy clay somewhat firm but easily friable; some roots; a few pebbles.
C_1	60 - 74"	Red gravelly and cobbly heavy clay with a few large stones; friable when removed; the coarse material is almost wholly quartz; a few concretions. The roots end here.
C_2	74 - 88" plus	Red heavy sandy clay mottled with yellow and dark red; many concretions; firm to semi-indurated.

This is considered a productive soil.

(It's very hot in these pits.)

I look at another profile part way down on a slope of 20 percent or so that is somewhat more yellow than the last.

A_p	0 - 1½"	Dark reddish-brown granular sandy clay loam; brittle, porous, and easily friable.
A_3	1½ - 15"	Reddish-brown sandy clay loam; vertical cracking; dark reddish-brown coatings on sides of cracks; digs out in fairly friable irregular nut; many roots and insect holes; a few quartz pebbles; some small fragments of charcoal.
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B_3	45 - 60"	Red coarse sandy clay somewhat firm but easily friable; some roots; a few pebbles.
C_1	60 - 74"	Red gravelly and cobbly heavy clay with a few large stones; friable when removed; the coarse material is almost wholly quartz; a few concretions. The roots end here.
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(It's very hot in these pits.)

I look at another profile part way down on a slope of 20 percent or so that is somewhat more yellow than the last.

Sample No. 46 - C only

A_p	0 - 1"	Dark grayish-brown granular sandy clay.
A_3	1 - 9"	Dark yellowish-brown, with reddish tint, fine sandy clay; roughly prismatic; breaks out in medium to large nut friable with difficulty. Macro-aggregates have dark brown coatings.
B_1	9 - 20"	Yellowish-brown fine sandy clay; some vertical cracking; macro-aggregates have dark yellowish-brown coating; large subangular nut; hard but friable with difficulty.
B_2	20 - 38"	Mottled yellow and yellowish-brown fine sandy clay; firm; breaks out in friable irregular medium nut.
B_3	38 - 55"(50-60")	Yellow heavy gravelly clay mottled with red; a few small concretions and many quartz pebbles and cobbles.
C	55 - 80" plus	Beautifully mottled yellow and pinkish-red silty clay; firm in place but friable; a few small concretions. (Special sample taken in brass tube.)

Roots go only to about 3 feet. This is a rather poor soil, partly because of the compaction above the gravel layer.

For the last two days I have noted repeatedly a layer of quartz cobbles in most of these soils. I wonder if this could be an old erosion pavement long since covered. It would take some considerable time to establish definitely the origin of these gravelly and cobbly layers. I am confident that this landscape has gone through great geomorphological changes, probably with changing climates.

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B_3	38 - 55"(50-60")	Yellow heavy gravelly clay mottled with red; a few small concretions and many quartz pebbles and cobbles.
C	55 - 80" plus	Beautifully mottled yellow and pinkish-red silty clay; firm in place but friable; a few small concretions. (Special sample taken in brass tube.)

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At this station there are also large experiments with coffee. They are trying eight different scions on three different stocks. The best results are with SA 158, from India via Yangambi, on the native coffee. The yields run about 1,500 kilos per hectare.

We have a very pleasant dinner and evening with M. and Mde. Van Dale. They have been especially solicitous of my welfare and comfort. This is an excellent station and I am sorry not to be able to spend more time here. The Director had everything prepared so efficiently that I have had a very good day. I am told that M. Donis and I are the first to occupy the new guest house.

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July 6: Kondo to Luki Station to Matadi

We are up at 5:30 for an early start since we cannot go fast in this Ford pickup and the ferry at Matadi stops running at 5 o'clock.

We leave the Kondo station at 7:10 a.m. in order to have at least some time at the Luki station nearby, which is devoted exclusively to forestry.

In this region the forestry practice is to cut the trees, plant the land to bananas, and then plant forest seedlings. M. Donis is not sure yet how long will be required for the seedlings to develop into mature trees -- perhaps 60 years. Quite likely with more experience in forest management, the planting can be eliminated. One of the big forestry problems, in his view, is to acquaint people in the trade with many good species about which they have no present experience. If more of these kinds of trees could be used the planting of nearly pure stands could be eliminated.

As we reach the forest reserve I look at a sandy soil under the forest developed from schist on a slope of about 40 to 50 percent.

July 6: Kondo to Iwaki Station to Matsudi

We are up at 5:30 for an early start since we cannot go fast in this Ford pickup and the ferry at Matsudi stops running at 5 o'clock. [illegible], on the native coffee. The pickup run

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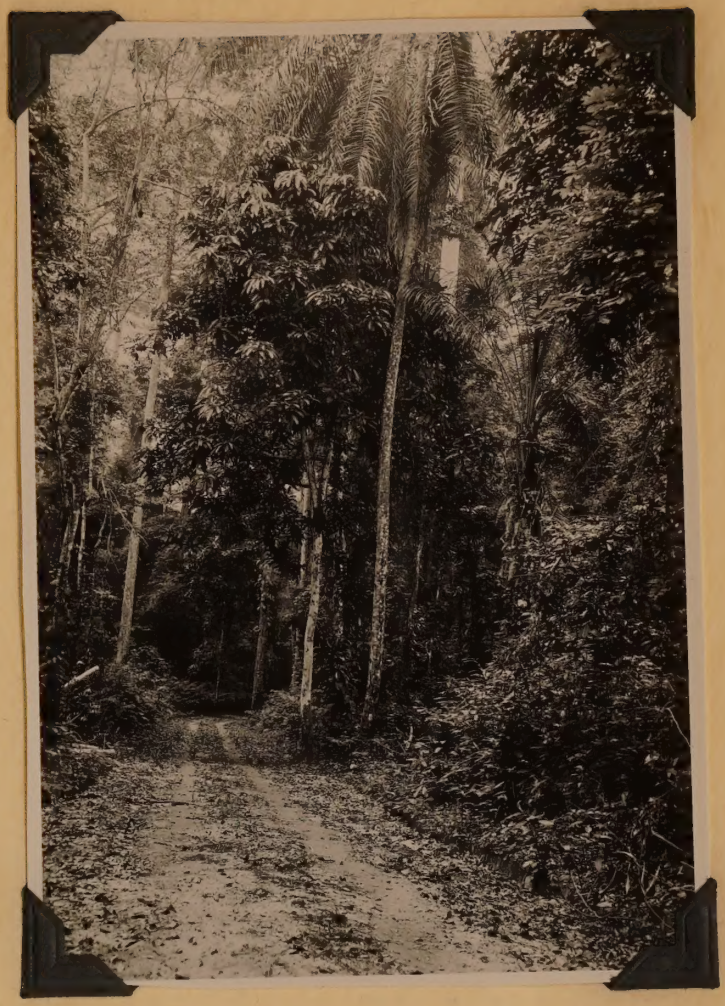
As we reach the forest reserve I look at a sandy soil under the forest developed from schist on a slope of about 40 to 50 percent.

K-1461 July 6, 1947
Belgian Congo. Luki. View of forest. Main trees are Terminalia. The undergrowth followed bananas in production in 1940.

K-1161 July 6, 1917
Belgian Congo. Luki. View of forest. Main trees are Terminalia. The undergrowth followed bananas in production in 1940.

K-1461a July 6, 1947
Belgian Congo. Luki. View of forest.
Main trees are Terminalia. The undergrowth
followed bananas in production in 1940.

K-1462a July 6, 1947
Belgian Congo. Luki. View of forest.
Main trees are Terminalia. The undergrowth
followed bananas in production in 1940.



K-1462 July 6, 1947
Belgian Congo. Luki. View of forest on sloping red lateritic soil. Cola tree with white trunk under palm in center.

K-1162 July 6, 1917
Belgian Congo. Luki. View of forest on sloping red lateritic soil. Cola tree with white trunk under palm in center.

Soil Profile Sample No. 47

A_{00}	1 - ½"	Loose dry leaves and twigs. (Not sampled)
A_0	½ - 0"	Brown decomposed organic matter and roots. (Some A_{00} in this sample.)
A_1	0 - 1" (½-2")	Grayish-brown loose coarse loamy sand; some roots and organic matter.
A_2	1 - 5"	Dull yellowish-brown loamy coarse sand; firm in place but easily removed. (Very pale brown when dry.)
A_3	5 - 16"	Yellow to yellowish-brown loamy coarse sand; firm; many roots. (Yellow when dry.)
B_2	16 - 43"	Yellow to yellowish-brown compact coarse sandy loam; digs out in brittle friable pieces; many holes of roots and insects. (Reddish-yellow when dry.)
C_1	43 - 58" (45-65")	Rotten schist with reddish-yellow sandy loam and some quartz pebbles.
C_2	58" plus	Partially weathered sandy schist, gray and pink.

The roots go to the C_2.

We drive down the road and I take pictures of the various types of trees. I look at a somewhat sandy red soil under heavy forest. This is near the lower part of a long 5 percent slope. The soil material is colluvial.

Soil Profile Sample No. 47

A_{00}	1 - $\frac{1}{2}$"	Loose dry leaves and twigs. (Not sampled)
A_0	$\frac{1}{2}$ - 0"	Brown decomposed organic matter and roots. (Some A_{00} in this sample.)
A_1	0 - 1" ($\frac{1}{2}$-2")	Grayish-brown loose coarse loamy sand; some roots and organic matter.
A_2	1 - 5"	Dull yellowish-brown loamy coarse sand; firm in place but easily removed. (Very pale brown when dry.)
A_3	5 - 16"	Yellow to yellowish-brown loamy coarse sand; firm; many roots. (Yellow when dry.)
B_2	16 - 43"	Yellow to yellowish-brown compact coarse sandy loam; digs out in brittle friable pieces; many holes of roots and insects. (Reddish-yellow when dry.)
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Table 26. Analyses of Red-Yellow Podzolic. (47)

Sample No.	Horizon	Depth	pH	Organic ~~Matter~~ Carbon	Size Class and Diameter of Particles (*in mm.*)							Other Classes (*in mm.*)		
					Very course sand 2–1	Coarse sand, 1–0.5	Medium sand, 0.5–0.25	Fine sand, 0.25–0.1	Very fine sand, 0.1–0.05	Silt, 0.05–0.002	Clay, <0.002	0.02–0.002	<0.005	>2
		Inches		*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
471659	A_1	0–1	4.6	3.4	7.5	39.3	18.8	17.6	3.4	2.7	10.7	0.9	10.4	0
1660	A_2	1–5	4.0	0.8	5.6	33.6	21.6	23.2	3.9	2.6	9.5	0.3	9.1	0
1661	A_3	5–16	4.0	0.4	4.6	26.7	17.6	21.3	5.5	4.6	19.7	1.9	19.9	0
1662	B_2	16–43	4.1	0.2	6.4	25.5	15.6	16.8	4.3	4.6	26.8	1.3	26.7	0
48845	C_1	43–58	4.8	0.2	6.8	26.4	17.2	20.4	5.5	4.5	19.2	2.6	20.1	0
846	C_2	58+	6.1	<0.1	14.1	37.5	18.1	21.9	4.7	2.7	1.0	1.4	1.4	0

			Exchangeable Cations me/100 g					Sum of Cations	% Base Saturation
			Ca	Mg	Mn	K	H	me/100 g	
471659	A_1	0–1	3.9	0.9	0.27	0.4	7.3	12.8	43
1660	A_2	1–5	0.4	0.2	0.04	0.1	3.6	4.3	16
1661	A_3	5–16	0.2	0.1	0.01	0.2	4.9	5.4	9
1662	B_2	16–43	0.1	0.1	0.01	0.1	4.5	4.8	6
48845	C_1	43–58	0.2	0.1	0.01	0.1	3.2	3.6	11
846	C_2	58+	<0.1	0.1	<0.01	<0.1	3.2	3.4	6

Congo Soil Profile No. 47

U. S. GOVERNMENT PRINTING OFFICE 16—46512-2

| Sample No. | Horizon | Depth | pH | Organic Matter | Very coarse sand 2-1 | Coarse sand 1-0.5 | Medium sand 0.5-0.25 | Fine sand 0.25-0.1 | Very fine sand 0.1-0.05 | Silt 0.05-0.002 | Clay <0.002 | Size Class and Diameter of Particles (in mm.) | | |

A_0		Very thin.
A_1	0 - 2"	Loose reddish-brown light sandy loam; partly single-grained and partly soft granular.
A_3	2 - 15"	Medium to dark reddish-brown sandy loam; slightly compact, but easily friable.
B	15 - 60"	Orange-red sandy clay loam; compact but easily friable to granular. Grades into:
C	60 - 80" plus	Orange-red sandy clay loam; a little heavier than the above and less compact; very easily friable.

The roots go to 80 inches. They are very numerous in the A_3 and upper B.

Here I try to get a picture of a Cola tree.

I look at another red soil under the forest on a gentle slope of 3 to 5 percent near the top of the slope. Likely this area was cultivated a great many years ago since a few fragments of black pottery may be seen in the A. The forest is so dense that it is difficult to examine the soil and describe it because of the shade.

A_0		Very thin.
A_1	0 - 2"	Loose reddish-brown light sandy loam; partly single-grained and partly soft granular.
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Soil Profile Sample No. 48

A_0 and A_{00} are very thin and are sampled together.

A_{10}	0-1"	Very dark reddish-brown clay; very porous; easily friable to rather firm granular. (Dark reddish-brown when dry.)
A_{11}	1 - 8"	Dark reddish-brown clay; firm in place; well-developed irregular nut with dark coatings; friable with hard pressure. Very many roots and insect holes. (Reddish-brown when dry.)
A_3	8-13"	Transitional; not sampled.
B_1	13 - 19"	Reddish-brown heavy clay; subangular medium nut. (Yellowish-red when dry.)
B_2	19 - 40"	Red, with slight orange tint, clay; firm and springy; poorly developed blocky structure; fairly easily friable. (Red to slightly reddish-yellow when dry.)
B_3	40 - 72"(65-80")	Like the above but a trifle lighter in color and more friable. (Yellowish-red to red when dry.)
C_1	72 - 80" plus	Mixture of red or pinkish-red clay and quartz pebbles and stones. This is the familiar quartz layer. These pebbles are partially weathered and break easily. Probably there is less stony material at great depths. (Yellowish-red to red when dry.)

Underneath the loose material there is said to be amphobolic intrusive rocks. M. Donis will try to send a sample later. Although the roots go very deeply, they are concentrated here in the upper 12 inches. The natives consider this soil the best in the region for their food crops.

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B_1	13 - 19"	Reddish-brown heavy clay; subangular medium nut. (Yellowish-red when dry.)
B_2	19 - 40"	Red, with slight orange tint, clay; firm and spongy; poorly developed blocky structure; fairly easily friable. (Red to slightly reddish-yellow when dry.)
B_3	40 - 72"(65-80")	Like the above but a trifle lighter in color and more friable. (Yellowish-red to red when dry.)
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Table 1. Analyses of Red Latosol. (48)

Sample No.	Horizon	Depth	pH	Organic ~~Matter~~ Carbon	Size Class and Diameter of Particles (*in mm.*)							Other Classes (*in mm.*)		
					Very course sand 2–1	Coarse sand, 1–0.5	Medium sand, 0.5–0.25	Fine sand, 0.25–0.1	Very fine sand, 0.1–0.05	Silt, 0.05–0.002	Clay, <0.002	0.02–0.002	<0.005	>2
		Inches		*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
471663	A_{10}	0–1	7.0	6.1	1.8	10.4	10.0	14.2	3.1	9.7	50.8	6.8	54.4	0
64	A_{11}	1–8	6.1	2.2	1.4	9.6	10.1	15.1	3.7	9.9	50.2	6.6	53.6	0
65	B_1	13–19	5.9	0.6	1.2	7.0	7.2	10.9	3.0	4.5	66.2	3.0	67.0	0
66	B_2	19–40	5.3	0.4	1.1	6.2	6.5	9.7	2.9	4.1	68.5	3.2	71.4	0
67	B_3	40–72	5.3	0.2	2.6	4.3	3.9	6.9	2.2	4.5	75.6	4.6	77.0	1
68	C_1	72–80	5.3	0.4	4.7	5.2	3.5	6.8	2.2	5.6	72.0	7.2	74.8	19

Sample No.	Horizon	Depth	Exchangeable Cations me/100 g					Sum of Cations me/100 g	% Base Saturation	Total P	Available P
			Ca	Mg	Mn	K	H			Pct.	ppm.
471663	A_{10}	0–1	26.4	5.3	0.15	0.5	4.9	37.3	87	.058	19
64	A_{11}	1–8	9.2	2.5	0.12	0.2	7.7	19.7	61	.047	6
65	B_1	13–19	2.3	1.6	0.04	0.2	5.3	9.4	44		
66	B_2	19–40	1.4	1.2	0.05	0.1	6.1	8.9	31	.026	3
67	B_3	40–72	1.1	0.6	0.04	0.2	5.3	7.2	26		
68	C_1	72–80	1.3	0.5	0.07	0.4	5.3	7.6	30	.022	4

Occasional horizons were not analyzed.

Congo Soil Profile No. 48

U. S. GOVERNMENT PRINTING OFFICE 16—46512-2

Congo Soil Profile No. 48

Table 1. Analyses of Profile No. 48

Sample No.	Horizon	Depth	pH	Organic matter	Very coarse sand 2–1 mm	Coarse sand 1–0.5 mm	Medium sand 0.5–0.25 mm	Fine sand 0.25–0.1 mm	Very fine sand 0.1–0.05 mm	Silt 0.05–0.005 mm	Clay <0.005 mm	Other Classes (mm) 0.08–0.005	<0.005	>2
47855	A1	0–7	6.0	1.6	1.8	10.4	10.0	14.8	3.1	3.7	8.8	8.8	54.4	0
48	C1	7–18	5.9	0.6	1.4	3.5	7.1	12.9	11.1	3.5	8.0	5.5	52.5	0
49	C2	18–40	5.8	0.4	1.5	4.3	6.3	9.8	5.0	4.5	8.5	6.0	54.0	0
50	C3	40–72	5.8	0.3	1.4	4.3	6.3	8.8	3.3	4.8	8.8	4.3	52.8	1
51	C4	72–80	5.8	0.3	1.4	4.3	6.3	8.8	3.3	4.8	8.8	4.3	52.8	1

Occasional laterite gravel throughout profile.

Mechanical Composition of Fine Earth (<2 mm)

Sample No.	Horizon	Depth	Very coarse sand 2–1 mm	Coarse sand 1–0.5 mm	Medium sand 0.5–0.25 mm	Fine sand 0.25–0.1 mm	Very fine sand 0.1–0.05 mm	Silt 0.05–0.005 mm	Clay <0.005 mm	Total	Available	Fe	Mn
			% of Total Base Position							%	%	ppm	ppm
47855	A1	0–7	13	25	18	18	8	5	14	0.20	0.02	1.0	0.5
48	C1	7–18	12	24	18	19	8	5	14	0.10	0.01	1.0	0.5
49	C2	18–40	13	24	18	19	8	5	13	0.05	0.01	1.0	0.5
50	C3	40–72	13	24	18	19	8	5	13	0.05	0.01	1.0	0.5
51	C4	72–80	13	24	18	19	8	5	13	0.05	0.01	1.0	0.5

K-1463 July 6, 1947
Belgian Congo. Luki. Pennisetum grass on alluvial glei soil.

17-9

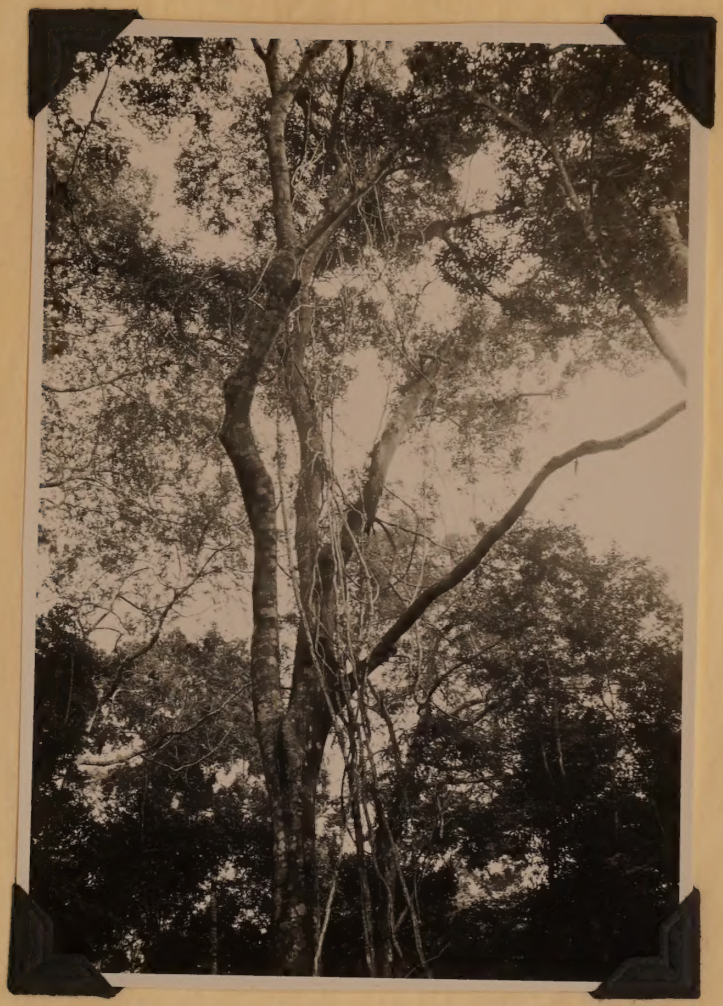
K-1163 July 6, 1917
Belgian Congo. Luki. Pennisetum
grass on alluvial flat soil.

K-1464 July 6, 1947
Belgian Congo. Luki. Forest has invaded savanna on dark yellow sandy soil here after years of fire protection. Now fire is not a serious hazard.

17-10

K-1164 July 6, 1917

Belgian Congo. Luki. Forest has
invaded savanna on dark yellow sandy soil
here after years of fire protection. Now fire is
not a serious hazard.



K-1465 July 6, 1947
Belgian Congo. Luki. Pippadenia tree with vines.

K-1165 July 6, 1947
Belgian Congo. Luki. Pipadenia tree with vines.

Hurriedly I look at two more profiles on rather strong slopes not far from one another. The first one is under dense forest with about 15 to 25 percent slope.

A_1	0-5"	Brown sandy clay loam; friable.
A_3	5-17" (12-20")	Brown gravelly clay mottled with yellowish-brown and red.
B_2	17-48"	Irregular; reddish-brown clay with gravel and stones of quartz.
C	48-70" plus	Partially weathered schist, banded gray and reddish-pink.

The roots are shallow. The soil is only fair even for trees.

On a similar slope nearby I look hurriedly at a soil under savanna.

A_1	0 - 12"	Grayish- and yellowish-brown sandy clay; very hard; digs out in hard nut; many pebbles and cobbles of quartz.
A_3		Transitional.
C		Pinkish partially weathered schist.

This soil is obviously low in organic matter with poor structure and drier here under the savanna than in the forest.

We drive down onto alluvial glei soil under dense very tall pennisetum grass. The water table is at 46 inches.

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This soil is obviously low in organic matter with poor structure and drier here under the savanna than in the forest.

We drive down onto alluvial flat soil under dense very tall pennisetum grass. The water table is at 46 inches.

A_1	0 - 7"	Mottled dark yellowish-brown and dark grayish-brown sandy clay loam; coarsely prismatic and falls into large blocky.
A_3	7 - 13"	Like the above but lighter in color.
G_1	13 - 24"	Yellowish-brown and dark brown mottled compact sandy loam.
G_2	24 - 34"	Yellowish-gray sandy loam.
G_3	34 - 46" plus	Massive clay finely mottled with gray and brown.

On this same stream bottom I look at an excellent Half-Bog soil.

A_1	0 - 7"	Black wet gramular clay; many roots.
G_1	7 - 10"	Gray sandy clay mottled with yellowish-brown.
G_2	10 - 24"	Light gray and yellow mottled sandy clay.
G_3	24 - 28" plus	Gray and yellow mottled sand and gravel.

The cover here is a good savanna with a few trees. The natives consider this a productive soil for cassava and peanuts, but this is a rare soil and is only found where the natural levees of large streams have blocked the drainage of small alluvial valleys.

In this area the natives clear the savanna for peanuts and very often the crop is followed by the very bad savanna grass -- Imperata. Once established, this grass is likely to

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On this same stream bottom I look at an excellent Half-Bog soil.

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K-1533 July 6, 1947
Belgian Congo. North of Gimbi in native village.
Native hair-dressing.

K-1534 July 6, 1947
Belgian Congo. Just south of Gimbi. Forest
invading savanna following fire protection.

K-1532 July 6, 1947
Belgian Congo. North of Gimbi in native village.
Native hair-dressing.

K-1536 July 6, 1947
Belgian Congo. Just south of Gimbi. Forest
invading savanna following fire protection.

stay a long time since it is exceedingly difficult for other plants to come in.

We go to lunch at M. Donis' headquarters. He has a relatively small house. From the living room there is a beautiful view of a hilly forest area. There are wide heavy forest galleries in the valleys and on the lower slopes with a patch work of savanna and forest on the higher land.

After lunch we leave for Matadi. We drive back by way of the Gimbi station and over the same roads, for the most part, that we travelled before. I get a few more pictures of vegetation.

We are back to Matadi in our hotel shortly after 5 o'clock. I find that the Prince Regent is in Matadi and goes tomorrow to Leopoldville by special train. I hope we don't conflict with one another!

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July 7: Matadi to Leopoldville

We are up early for the train. Matadi is all decorated and the crowd is gathering at the station to see the Prince Regent off at 8 o'clock. (He has a special train from 8 to 5, while our train goes from 7 to 6.) He leaves at 7 o'clock.

North of Matadi are several hills with well-developed erosion pavements of quartz fragments mainly. I suspect that these are the forerunners of the deep stony horizons described in the soils near Kondo.

While in the train I count up 247 soil samples taken in the Congo. Of these, 216 are to be sent from Yangambi and 31 by M. Donis from Boma.

This is a very tedious train ride. I spend a great deal of the time preparing a radio script for use in Leopoldville.

We arrive in Leopoldville on time at 6 p.m. I find no mail! In the evening I have an interview with the radio people about my speech for tomorrow.

July 7: Watsadi to Leopoldville

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July 8: Leopoldville

In the morning I sort out materials to be sent back to the United States by freight. I take a box of work clothes and field equipment to the American Consulate, together with a complete list, and they agree to send them.

In the middle of the morning I go to the radio station to make a disc for use to America and England. This will be translated from English into French by M. Donis and put on the air later for the Congo. M. Donis wires Director Jurion the time of the English broadcast tonight.

I get my ticket to Brussels, send off the rest of the kodachromes, and do some other shopping in order to be ready for the trip back tomorrow.

Radio interview

ANNOUNCER

We have tonight in the Leopoldville studio of the Belgian National Broadcasting Service, Doctor Charles E. Kellogg, the Chief of the Division of Soil Survey of the United States Department of Agriculture, who has accepted to grant us an interview on the tour he has been making in the Belgian Congo. Dr. Kellogg has been invited in the Belgian Colony by the National Institute of Agronomic Studies in the Congo, the I.N.E.A.C., and by the Belgian Government.

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So here is Mr. Kellogg answering a few questions which will no doubt greatly interest our English and American listeners.

INTERVIEW

- Could you tell us, Mr. Kellogg, which parts of the Belgian Congo you have had the opportunity of visiting during your tour of the Colony?

- I arrived in Stanleyville on June 2d. After a few days at Yangambi, main station of INEAC, I went by car to Bambesa in Uele with Mr. Jurion, Director General of INEAC in the Congo. We had one day at the cotton station there. By car, we visited the National Park and the elephant training at Gangala-na-Bodio. Then we drove on through Ituri, visiting the INEAC stations at Mount Hawa and Nioka. After Nioka, we went south through the Albert National Park to Lake Kivu, then east through Ruanda-Urundi, visiting two experiment stations -- one at Rubona and another at Nyahaga. From Astrida, we drove to Usumbura and from thence to Costermansville with a stop at the INEAC cotton station near Lubdrika. Two days were spent at the important INEAC station at Mulungu near Costermansville. Since time was short, we flew from Costermansville to Elisabethville, where I spent several days studying the soils of the region with the INEAC scientists.

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I also had a look at the native welfare work of the Union Miniere.

From there I flew to Kamina and visited an important soil and vegetation survey party at Kaniama. This branch of INEAC's work is especially important to the success of future settlement. From Kaniama, we went by car to Luluabourg, and from thence by plane to Leopoldville. (And, by the way, arrived just in time to see the Prince Regent come.)

Three days later, I went into the Low Congo with Mr. Donis of INEAC. We stopped first at the important fruit station at M'Vuazi then on by train to Matadi. From there, we drove north into the Mayumbe where INEAC has three stations; the fiber station at Gimbi, the forest station at Luki, and a station at Kondo, which deals with oil palm, rubber, bananas, and other important crops.

I've just returned to Leopoldville for a plane back to the INEAC headquarters in Brussels. Of course, I've mentioned only a few of the places visited in the Congo.

- Well, it seems that your tour has been a very complete one.

- And what are your impressions, Mr. Kellogg, on the work that has been accomplished so far in the stations of INEAC?

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- Well, it seems that your tour has been a very complete one.

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- Very favorable, and especially so when one considers the short time INEAC has been functioning and the difficulties of the war period. A most excellent beginning has been made in the application of science to tropical agriculture. In the temperate countries of Europe and America, we are inclined to take for granted the greatly increased agricultural efficiency that has come about through the scientific research of the past one hundred and fifty years. INEAC has shown definitely that similar or even greater development is possible here. But it will take time, resources, and above all, sound scholarship.

Also, I think INEAC has gotten well started by having an integrated program, with all kinds of scientists working together. Certain additional field studies, experimental stations, and laboratories, and especially more broadly trained young scientists, are obviously needed. Then too, detailed maps, based upon aerial photographs, are essential for some of INEAC's most important work, which are not yet in hand. But the work has developed much more rapidly and more soundly than I had expected. No small part of this great success has been due to unusually good administrative direction.

- Yes ... And what do you think, Mr. Kellogg, of the agricultural progress among the natives and of the work they are doing under the supervision of the agents of INEAC?

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- Yes ... And what do you think, Mr. Kellogg, of the agricultural progress among the natives and of the work they are doing under the supervision of the agents of INEAC?

- One of the things that impressed me most favorably about INEAC, is its sound concern for the natives, both as future citizens and in relation to the whole economy. Some of the most striking successes in research have been for food crops for the natives, as well as with industrial crops for both native and European farmers. Of great significance for the future well-being of the Congo, are the native cooperatives, designed to help them achieve a better standard of living through both food growing and production for orderly sale.

- Yes, native welfare certainly is of first importance. And now, to come to a more technical problem, concerning soil erosion, Mr. Kellogg, what is the situation in the Belgian Congo?

- Recently, soil erosion has received great attention, as it should; but it is not everywhere a serious menace, by any means. In fact, erosion itself is primarily a symbol of declining soil productivity rather than a cause.

Here in the Congo, I have seen some erosion -- and more especially in Ruanda-Urundi, where there is a severe over-grazing. In these parts, cattle numbers will be reduced, either by orderly administrative programs or by continued erosion, depletion of the pastures, and cattle starvation. Certainly, it will be better if the cattle are reduced by orderly methods that will maintain or increase production

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through improved breeding. The people of INEAC and in the Agricultural Extension Service know what to do and have already done excellent work. In the hilly sections, where erosion is evident, programs for terracing and for tree planting in the critical places need emphasis right now, while there is time.

- So it seems, from your survey, Mr. Kellogg, that the soil of the Belgian Congo is not immediately threatened?

- A far greater menace to the soil of the Congo than erosion is the burning of the savanna. Large areas, once forested, are now savanna. Here, one can't go into all the reasons why grassland soils in the humid tropics are less fertile than those under forest. But it is generally so. If only the fires could be stopped, large areas would become productive for commercial timber and, with proper management, for food and industrial crops. This problem of fire protection is of the greatest importance to the future of the Congo.

- Now, taking into account the present degree of erosion and the dangers which, as you have just told us, are the consequence of the burning of the savanna, what do you think of the possibilities and of the future development of agriculture in the Belgian Congo?

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- I think they are good — very good. We have only begun to apply agricultural science in the tropics. There is much to be learned about tropical soils, fertilizers, plant protection, and the adaptation of varieties. The prosepcts are excellent that these things will be learned.

But, of course, to prosper agriculturally, education and public health services must be further improved. And a highly technical agriculture is closely related to industry. All phases of the economy must grow together. One can't expect efficient agriculture in the Congo without industry here as well. But I have seen enough to convince me that the population is capable of both.

- Thank you Mr. Kellogg, and as we know that you were the Secretary of the Agricultural Committee of the United Nations Food and Agriculture Organization at its first conference in Quebec, could you tell us your opinion on the opportunities and the possibilities of this organization?

- First of all, I firmly believe we will have one world or none. This may sound too idealistic, but I see no alternatives besides worse wars and destruction on the one hand, and a peaceful system in which all people have a reasonable opportunity for the good life, on the other. Perhaps, it is because I am a simple man, but I can see myself no barriers to peace

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that reasonable people of good will and ambition to work, could not remove.

Without production, especially production of good, healthful food, there can be no peace. No group of people in the world can remain easy while others fear the approach of another day — while they have nothing to lose.

By exchanging ideas and experiences, all scientists gain in their work. Two experiment stations working together can accomplish more than twice as much as each working alone. Every research worker in the world benefits from the work and ideas of others in the same field. As the number working together increases, the extra values from cooperation greatly increase. That is why I have been so much interested in international cooperation among agricultural scientists everywhere. It is relatively easy, because the language of science is international, and its benefits of abundant production are essential to peace.

- Yes, and as you said, peace is essential today to human survival. And, finally, Mr. Kellogg, we think our listeners should like to know the general impression of your first visit to the Belgian Congo.

- Perhaps, first of all, I have been impressed by the friendly courtesy of the people, both European and native. Certainly, one is made to feel welcome in the Congo; then the color of the landscape — great trees, flowers, fruits,

and red soil (as well as the dresses of the native women in the market place).

The great variety of conditions in the Congo give interest and charm. It increases enormously the task of the scientists in the INEAC, of course, but it means potentialities for many kinds of trees and crops, and thus a stable economy.

So far as I could see and understand, I am favorably impressed with the program for native development and with the recognition of the rights of natives as people. I was surprised to find, for example, that the engineer on my train to Matadi was a native, and the station masters along the route as well. That is good.

Most officials I met seemed to have that balance among patience, kindness, and firmness, that will lead to continued growth of the Congo as a country.

- Well, thank you Mr. Kellogg, for answering so kindly and with such great competence, these questions on your views on agriculture in the Belgian Congo. We are sure our listeners have taken great interest in all the so accurate information that you have just given them on the Belgian colony.

ANNOUNCER

You have just heard an interview with Doctor Charles E. Kellogg, the Chief of the Division of Soil Survey of the United States Department of Agriculture, who has just completed a tour in the Belgian Congo.

Let us add, as a conclusion, that the scientific work of the INEAC established by King Albert, has just been completed by the creation of an institute for scientific research in the Congo. This decision, which was announced a few days ago by the Prince Regent, will contribute to the advancement of the Belgian colony in every field, by enabling scientists and research workers to join hands with the colonists and colonial agents in the work of development of the resources of the Belgian Congo.

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July 9: Leopoldville

I am up early for the plane to Brussels. The plane bus comes to my hotel at 7:15 a.m. and takes me to the airport. Then, and not until then, I am told that the flight has been postponed 24 hours! What arrangements! No call to the hotel and the airplane company even sends out the bus when the flight had been postponed 12 hours before that! Certainly this is reason for righteous anger.

Fortunately, I had received yesterday several packs of black-and-white film that had been developed in Leopoldville. So I work all day on the pictures and write the captions for 96 of them.

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July 10: Leopoldville to the Sahara

I am up early again for the bus to the airport. At 7:30 a large group is waiting for this plane. I have to go through customs to get out of the Congo! And even have to pay 33 francs export tax on a handful of little ivory elephants! This tax is certainly not likely to be attractive to the tourist.

The plane is a large four-motored American DC-4. I am on the plane at 9 a.m.

Although the first on the plane, I am arbitrarily given a very poor seat despite an explanation of my work. So far Sabena has given me an exceedingly poor impression as compared to Sobelair.

We are in the air at 9:20 a.m. and soon pass over to the north side of the Congo. With this poor seat over the wing and the air very hazy, I see little. Almost immediately we are above a complete cloud cover. It is somewhat peculiar that in the dry season it is often very cloudy in Leopoldville; in fact, much of the time it looks as if it may rain the next minute, but it doesn't.

Fortunately, the captain of the ship comes back into the cabin and changes me to a good seat. But we are still over a dense cloud cover.

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Near Moutamba the clouds break enough for me to see dense forest below. The land appears to be a rolling plain with slightly darker green trees in coves and along the stream channels. I see a few scattered open cultivated spots in the uplands. The crop is probably bananas. The soil is orange-red. The streams are fully mature and the terraces along them generally cultivated. The area is sparsely populated. A few miles beyond I see some sort of plantation with trees, probably rubber.

Out about 300 miles the land is somewhat more hilly. Near Ndendé the land through the haze of thin clouds appears to be rolling forest land, soon changing to undulating and level with only very few clearings. Northwest the land appears to be wet and swampy for some distance.

Unfortunately, we pass over heavy clouds again. I get only glimpses of the bay north of Cape Lopez. North of Libreville there appears to be mostly forest along the coast with just a few clearings. Where I see the coast line through the clouds it seems to be sharp -- neither swampy nor with cliffs. Then we turn out to sea over the Bight of Biafra.

At 1:25 we pass over a large delta on the south coast of Nigeria. Far to the west I think I see the Niger River.

As we come inland we pass over an undulating plain with post-mature streams. The area is forested and much of it is

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As we come inland we pass over an undulating plain with post-mature streams. The area is forested and much of it is

swampy. There are many clearings in the uplands, at least part of which have cereals. About one-third of the crop land is either cleared fallow or very young seedings. The soil is a dark reddish-brown. There are a good many villages.

About 40 miles inland from the south coast of Nigeria, perhaps better than one-half of the land is in crop. A very winding river to the east disappears from view to the north-east.

We are now going against a very strong head wind so the plane is only making about 180 miles per hour. Clouds are below us, above us, and all around us.

About 60 miles inland, just below Afikpo, one glimpse only shows me that we are over red soil on more sloping land. Then again heavy clouds and rough sailing.

About 80 miles inland near Afikpo I see quite a bit of cleared land on rolling red soil. The forest is quite thin. We must be over a region of dense population.

Somewhere around 90 to 100 miles, possibly near Abakaliki, we are over thin forest and savanna with red soil, some of which is eroded. I suspect a heavy population.

Occasional glimpses through the clouds as we go north indicate continually less forest and more savanna, especially on hilly land, with a few gallery forests. I suspect this land has been pushed very hard for production. I see some

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spectacular gullying with beautiful head lands into the red soil.

As we go farther I see considerable deep gullying of strongly rolling red soil. Most of the land here is gently rolling and heavily cropped. Without doubt, much of the serious gullying has probably been accelerated through intensive cropping, in part at least; although it is obvious that this region is undergoing active normal geological dissection. It is impossible to determine from the plane how much of the gullying is accelerated erosion. Along here one sees many dry stream beds -- some very large ones with braided red sandy beds.

I rather suspect part of this land may be considerably overpopulated in relation to its productivity under native management. In the most rolling parts are a good many narrow sharply V-shaped deep drainageways cut into the red and dark red soil.

We pass through this eroding area, probably near Okwoga, into an intensely cultivated area of gently rolling red soil. There are patches of good forest in favored places. The population is heavy. Again the clouds now obscure most of the land. These clouds are being carried south by a very strong head wind.

Near Oturkpo is gently rolling land with thin forest and medium forest, both mixed with savanna. Although there are

some cleared patches, the population is not so heavy.

We cross the Benue River — the east fork of the Niger. The water is muddy — reddish-brown in color — and I see orange-pink sand flats along the stream. For a little way north of the river the soil is generally brown rather than red.

Twenty-five miles north of the river the land is rolling and covered with mixed savanna and trees. Many low hills are nearly barren. Cultivation and villages are seen in the favored places. The soil is brown or reddish-brown, not red. The trees gradually diminish as we go north.

About 35 or 40 miles north of the river the population is somewhat heavier. In fact, many areas are densely populated for savanna country. The soil is mostly brown and gently rolling with mild dissection. There is little if any significant erosion apparent. A few small rounded black hills look to be volcanic, but probably are not.

We pass Jatia Beriberi. There is only a little forest in small patches and very narrow galleries. The savanna, which looks quite green now, has scattered low trees and shrubs.

Just north of Wamba there are more steep-sided rounded low black hills. Some of these are small mountains. A few miles farther north they become bolder. Beyond, there is

rolling brown soil with some rock outcrops and sharp local relief. We soon leave the rock outcrops and pass over gently rolling reddish-brown soil. On the whole, this is well populated. Many fields are clean fallow or only recently seeded. Trees are seen only in thin narrow galleries. The individual huts of the small villages can scarcely be seen from the plane. These are brown and partly round and partly square or rectangular. They are grouped in small separate clusters. A wide variation in the quality of the soil must exist among local soil types since some large and some small areas in this well-populated region have almost no fields nor villages.

East of Kaduna there is a strip of low hills and rock outcrops. I suspect that many fields have young maize or grain sorghums.

We pass Rahama. Beyond the town is undulating to gently rolling brown and reddish-brown soil intensively used. But as before, some considerable areas are not used at all. There are also low rounded dark hills.

As we continue north near Kano, the plain is gently undulating and most intensively cropped. I suspect that parts are overpopulated. Some soil is brown, some reddish-brown, some gray, and some grayish-brown. Along the shallow dry water course, I see some salty soils. Part of the land is irrigated. Here the native houses are mostly round with

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conical thached roofs. Single huts or groups up to 12 in one spot are surrounded by a mud and picket fence or a hedge of small trees, or both. Maize is an important crop.

We are down at Kano at 4:06 p.m. The passengers are taken at once in a little bus to a barracks about a mile away -- a "hotel" -- for a combined lunch and dinner.

The soil here is nearly level and orange-red in color. I see lateritic concretions in the roadways that probably haven't been brought far. The plain is nearly treeless. It is much warmer here than in Leopoldville.

Just outside of the "hotel" there is a great deal of bargaining between the passengers and Arab traders with all sorts of trinkets for tourists. I am offered a camel's hair blanket for $20.00; in turn, I offer $10.00; but nothing comes of it. The traders do a great business with most of the other passengers and even with part of the crew. The greater part of their things are poorly made from snake and alligator skins.

We are back in the plane at 5:20 -- 10 minutes late because of the strong head wind. It is terribly hot in the plane.

We are in the air out of Kano at 5:30 with the next stop scheduled at Tunis. I see some little thunder showers around us in the distance. At Kano there is a large native city

with reddish-brown rectangular mud houses packed very tightly together. Obviously there is a strong Arab influence on the architecture and layout. The country north of Kano is also very densely populated.06 p.m. The passengers are ---

Shortly after leaving Kano we pass over a little dust storm. ---" For a combined lunch and dinner.

I have never seen more densely settled native farms before. If there isn't trouble here over land now, there certainly will be. Better than one-half of the crop land is clean fallow or nearly so. Dwarf trees are scattered about nearly everywhere. Of the "hotel" there is a great deal of

Forty miles north of Kano the trees are somewhat thinner and the soil generally a little lighter in color, but still densely populated. Just before crossing over the Niger of French West Africa, the land seems notably drier with gray upland soils. Yet the population is dense. There is only a small proportion of uncultivated scrub land in this obviously dry country.

A little way south of Zinder we pass over a strip of undulating land with long narrow oblong depressions that take up about one-quarter to one-half of the total area. These run northwest to southeast and are about one-half swamp or gray low land and about one-half water.

As we approach Zinder the field pattern is still nearly complete. But villages are farther apart. We are now

getting into the reddish-brown soil of the semi-desert. Beyond Zinder the proportion of crops falls off in favor of thin low shrub land; but yet there are many people for such dry land.

I see a few small steep-sided reddish-brown "haystack" buttes sticking up in the plain west of Zinder and they extend north for a few miles. Some have weird outlines like animal crackers.

Very gradually the land takes on the appearance of desert "hard land" with the grays and light browns predominating. Gradually the fields become fewer and fewer. In places the shrub land looks nearly black with many almost circular light brown spots.

What a hard life it must be here!

But still there are many people and, in a few places, nearly solid layouts of fields, though now I see no crops at all. We are flying too high to determine definitely, but I suspect that here some of the people may be living in tents rather than huts.

About 40 or 50 miles north of Zinder, perhaps near Gangara, the land is already nearly desert. In the undulating yellowish-brown plain are many small depressions with a few shrubs in them. Yet for a long way farther north here I see roads, villages, and layouts of fields scratched on the hard land. Farther north the desert is mottled and streaked with

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water courses, low dark brown rock outcrops, and playas. It seems perfectly clear to me that this area once had more rainfall than it has had in the last thousand years or so.

Beyond Djadjidouna little vegetation may be seen except on the margins of the sand-filled water course. But still there are some houses and apparently some tents. A little farther north the desert has a few more shrubs thinly scattered on light reddish-brown soil. But then this vegetation gradually fades and the land becomes nearly barren again.

What a pity it is getting dark!

At 7:05 p.m. I am due west of the Massif de Termet. The desert appears somewhat reddish-brown here with broad gray mottlings (exposed croûte calcaire?) and seems to have a hard surface with broad depressions and valleys filled with shallow orange-yellow sand. Here I see no signs of people.

As we go north we pass over broad sandy areas with dunes and ripples. At 7:30 I can just make out the dim-out lines of low hard ridges and sand-filled valleys.

So this day's observations end, somewhat south of the Algerian border in the real desert of the Sahara. By 8:30 p.m. we have likely crossed or are about to cross, the Algerian border.

The land beneath is dark. I cannot make out a light or anything. But above the stars shine brightly over Africa

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as they did in Alaska last year and in the Soviet Union the year before. I just finished reading a copy of the Paris edition of the New York Herald Tribune for July 6. The dominant tone is suspicion between the East and the West — jealousies and fears among the various groups of national leaders and bureaucrats. How unnecessary all this seems to me -- a simple fellow looking out of my plane window at the stars, like I did a thousand miles away a year ago and two years ago.

I try to sleep without much success.

Midnight.

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Midnight. -- I am due west of the Massif de Tenet. The desert appears somewhat reddish-brown here with broad gray mottlings (exposed erosite calcaire?) and seems to have a hard surface with broad depressions and valleys filled with shallow orange-yellow sand. Here I see no signs of people. As we go north we pass over broad sandy areas with dunes and ripples. At 7:30 I can just make out the dim-out lines of low hard ridges and sand-filled valleys.

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July 11: Sahara to Brussels

About two o'clock in the morning we run into very rough air. We can't be far from Tunis.

We are down at Tunis at 2:26 a.m. with a rough landing. We have a rather poor meal -- half breakfast and half dinner -- and then back to the plane at 4 o'clock.

At 4:12 a.m. we are in the air out of Tunis. In a few moments we are over the sea and the first glimmers of the gray dawn show in the east, with just a splinter of rose where the sky meets the sea.

The sun begins to shine on the land as we cross from the sea over the tip of Sardinia.

Later we pass over Toulon and along the west side of the Rhone Valley -- simply gorgeous in the bright morning sun -- and the western slopes of the French Alps.

Beyond, we have nearly solid clouds and a strong head wind over northern France and Belgium. So we shall be late.

It clears just before we land and I see thousands and thousands of greenhouses in both small and large clusters. We are down (hard!) at 10 o'clock in the Brussels airfield.

After I get through customs, I take the bus to the city and a taxi to the American Embassy. Here I get my mail and make a date with INEAC for this afternoon. I call the Paris Embassy about my reservation on TWA back to the United

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States and arrange for transportation to England with the American Express. I need to go to the bank and change Belgian Congo francs to Belgian francs. This is a terribly slow process and many, many papers need to be signed.

All of this uses up the day until 4 o'clock. I have not even had time to go to my hotel. Mr. Gospard of the Embassy takes me to the headquarters of INEAC at 12-14 Rue des Laines. Much to my surprise this 4 o'clock meeting is not to make arrangements, but for me to make a formal report to the Board of INEAC! Here I go, with no preparation and 39 hours without sleep or a change of clothes! This is quite an exercise for one who hasn't tried it.

After the meeting I go to my room at the Club de la Fondation Universitaire, 11, Rue d'Egmont. I write what is only essential and immediately go to bed without bothering about dinner.

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July 12: In Brussels

Early this morning I do a little shopping and then go out to INEAC for a conference with Lebrun and others of the staff.

Lebrun is especially interested in the soil and vegetation of the Albert National Park. He has a special monograph in press on the ecology of this area. He asserts with emphasis that there is no croûte calcaire in the park. But I am quite certain that I saw it in several places where the softer accumulations had been exposed and had had a chance to harden. In fact, I described it and sampled it! We discuss many of my observations and suggestions already outlined in these notes in various places. I agree that I will make copies of at least the more important parts of my notes for Director Jurion.

It is obvious that I am through at INEAC so I try repeatedly at the office of Sabena to get my reservation for London changed from Tuesday to Sunday -- tomorrow. But no luck.

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K-1466 July 13, 1947
Brussels, Belgium. City Hall.

K-1166 July 13, 1917
Brussels, Belgium. City Hall.

K-1467 July 13, 1947
Belgium. Brussels. City Hall

K-1468 July 13, 1947
Belgium. Brussels. View from Mort des Artes looking toward City Hall. And love in early morning.

K-1467 July 13, 1917
Belgium. Brussels. City Hall

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July 13: Leave Brussels

I am up early for a short walk to get pictures of the City Hall and of other famous places. I go back to the Club, pack my baggage, and explain to the manager that I shall try to find a way to get to London, but that probably I shall not succeed and will be back. He agrees to keep my room open until 6 o'clock. I tell him that if I am not back then he may assume that I have left Brussels.

I take a cab to the Sabena office where I am told there is very little chance of a plane. All places are taken. But I get into the bus to the airfield anyway. When I get out there, it is the same story -- all places taken. I wait until everyone is checked in, and at the last moment someone does not show up. I get the space, make all of my arrangements, and get through customs in not more than one minute.

I am in the air out of Brussels at 11:41 a.m.

I shall ever be grateful to Director Jurion, the leaders and staff of INEAC, the officials of the Belgian Government -- all those who did so much to make this trip possible for me in the first place, and who arranged it so that I could work so effectively.

Notes on the visits in England and Wales and the return to the United States are included in the second part of the Mediterranean Journal.

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